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MARCH, 1859.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Papers on Bridge Construction. By JOHN W. MURPHY, Civ. Eng. Philadelphia, Pennsylvania.

In beginning a series of papers on the theory and practice of bridge construction, it would seem most appropriate that the *arch* should first receive attention.

Among the ancient Romans, (who were essentially the first bridge builders,) the arch was made the primary feature of all their engineering and architectural constructions where the support of weights over spaces became necessary, and it has, indeed, ever since, been a favorite of the most distinguished engineers of every age, from the period of which I speak, to the present day.

I therefore propose to discuss the theory and practice of the construction of arch bridges when built in stone, iron, and wood.

The principles which govern the stability of the arch, are discovered by the investigation of two general problems.

1st, To find what weights will maintain the arch in equilibrium, when the line of pressures run parallel to the intrado.

Let A, K, M, Fig. 1, represent an arch which we may assume without error, to consist of the straight lines, M N, N O, O P, &c. And suppose that these lines are freely movable about the joints, M, N, O, . . K.

It is required to find what weights shall be placed on each joint, (a weight on any one joint being known or assumed,) so that the arch

shall be in equilibrium, and the joints, N, O, P, . . . K, remain in position at rest.

Represent these weights by N′, O′, P′, . . . K′, as they shall respectively act at the points, N, O, P, . . . K.

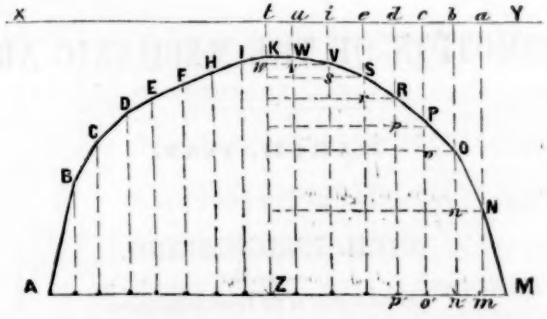
Draw the lines, N *m*, O *n*, . . . K *w*, in the direction of gravity, and the horizontal lines, *m* M, N *n*, O *o*, &c.

Now the pressure of all the superincumbent weights at and above N, will be conveyed to M, through the line N M.

And all above the joint O to the joint N, through the line O N.

Now the weight at N, acting in the direction of gravity, through the line N *m*, has its horizontal thrust at M = *m* M, and the weight at O, in the same manner its horizontal component *n* N.

Fig. 1.



Now that the points, N, O, P, . . . K, shall remain in equilibrium depends upon the condition, that the weight of the superincumbent mass, acting at N, shall produce a horizontal thrust in the direction *m* M, equal to the horizontal thrust induced by the weights above O, acting at O; and in the same manner, the weights acting at P, shall produce a horizontal thrust in the direction *o* O, equal to that at *m* M; and equal to that at *n* N.

And per consequence that all the weights, N′, O′, P′ . . . K′, shall have such values, that the horizontal thrust shall be equal at each joint of the arch.

Now, by construction, we have given to the lines *m* M, *n* N, . . N *m*, O *n*, &c., values, for they are geometrical conditions of the arch. Hence, to form a general equation.

Represent any vertical line such as N *m*, O *n*, P *o*, &c., by *a*. Any horizontal line such as *m* M, *n* N, by *b*; and represent the horizontal thrust, (which, by condition of equilibrium, must be constant for every joint of the arch,) by *h*.

Then we shall have,

$$(K' + W' + V' \ldots + N') : h :: a : b, \text{ or}$$

$$(1.)\ N' = \frac{a\,h}{b} - (K' - W' - V' - \quad);$$

which may be interpreted thus:—

The weight at any joint of the arch, as at K, W, O, . . N, *in order that equilibrium may be maintained, is equal to the length of the vertical line drawn from that joint to the intersection of the horizontal line drawn from the joint next below it. Multiplied into the horizontal thrust (which may be assumed at pleasure, but which must be constant for every joint).*

Divided by the horizontal distance of the next joint below intercepted by the vertical—minus the sum of all the weights applied above the point assumed.

It will be observed that the lines N M, N O, O P, &c., are the resultants of the *vertical weights* and *horizontal thrust* for each joint—and hence, the line of pressure of whatsoever material the arch may be constructed, will be parallel to the lines N M, N O, &c.

THE SECOND PROBLEM to be solved is to find the direction of the lines of pressure. When the weights above the points K, W, V, . . N, are known, the condition depending upon the horizontal thrust $=h$, being constant and the same for each joint.

Draw the line X, Y, and project the verticals to it—as at t, u, i, &c., represent by the distances t, K, u, W, . . a, N. The weight severally placed over the joints K, W, . . N, and let these weights finally as in equation (1) be represented by K′, W′, V′ . . . N′.

We will find from equation (1) a new line of *resultant pressures*, obeying the same law—as the fixed line M N, N O, . . W K. To describe this line divide for convenience the half span of the arch Z M, into any number of equal parts, this will make the value of b in equation (1) constant, and the same for every point N, O, P, &c., a and b, being the co-ordinates for the points N, O, P, &c., giving value to b, we find from equation (1)

$$(2.)\ a=\frac{(\text{K}'+\text{W}'+\text{V}'\ \ldots\ +\text{N}')}{h}\,b=m,\ \text{N}.$$

and in the same manner the value of a, may be found for any given joints as at O P. . . . K.

The constant value of h, in this last problem, must be determined from the weight K′, at the crown. This will be explained when we come to the practical part of our subject.

We have thus obtained two formulæ, the one expressing the ratio between weights or masses which shall be placed upon a given curve (or system of lines approximating to a curve), so that the curve may be maintained in equilibrium.

The other providing the co-ordinates (so to express it), which will describe a curve (or system of lines approximating to it), where the weights placed upon it may have any value.

I therefore propose to depend for principles in the construction of arches upon the two equations (1) and (2), knowing that they fulfil all the requirements of the practical Engineer, for whose benefit I am attempting to write.

(To be Continued.)

For the Journal of the Franklin Institute.

Solutions of some Topographical Problems, by "One Plane Descriptive Geometry." By JOHN M. RICHARDSON, B. S.

Topographical Problems.

Hills are most correctly represented by cutting them with a system of horizontal planes, and finding the projections of the curves of intersections. These curves are numbered, beginning at the lowest, or each one is marked by a number denoting its height above the lowest or datum plane.

The distance between the secant planes is dependent upon the accuracy with which it is necessary to delineate the surface. With any given distance between the secant planes, it is evident that the projections of the curves of intersection will be nearer together as the surface of the hill is steeper, and farther apart as the surface approaches nearer to horizontality.

The lines of intersection are called "contour lines," or "lines of horizontal section." The methods of determining these lines in the field and of plotting them, belong to Surveying, and cannot be explained here.

PROBLEM I. Fig 1.—To find the intersection of a given plane with a given hill.

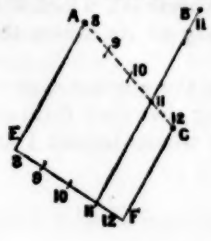
Let $(a, 0)$—$(b, 8)$ be the plane, and $(c, 0)$—$(d, 1)$—$(e, 2)$—$(l, 8)$ the surface.

Through each point of division of the scale* of the plane draw a horizontal line in the plane, and find the points in which it intersects the curve of the surface which lies in the same horizontal plane.

The horizontal line through $(m, 4)$ intersects $(g, 4)$ in two points which are projected in r and r'. In the same manner other points of intersection are determined, and the curve is $n\ p\ q\ s\ r\ t\ u\ v\ w\ x\ w'\ v'\ u'\ t'\ r'\ s'\ q'\ p'\ n'$.

PROBLEM II. Fig. 1.—The given surface being that of a hill, to compute the quantity of earth cut off by the plane and lying above it.

Divide the portion $q\ q'$ of the curve $(e, 2)$ into parts so small that they will not differ sensibly from their chords, and take corresponding parts of the curve $(f, 3)$. The trapezium whose projection is $e'\ d'\ e'\ f'$ may be regarded as coinciding very nearly with the surface of the ground, and $e'\ d'\ e'\ f'$ may be regarded as being the right-section of a small truncated prism whose lower base is in the horizontal plane, and



* The SCALE of a PLANE is a line divided into parts equal to the horizontal interval between the contour lines of that plane. The contour lines of a plane are of course all straight lines, and their horizontal intervals equal, since the inclination of a plane is the same in all parts.

The scale of a plane may be thus constructed. Let A, B, C, be three points in a plane, their heights above the datum being marked.

Draw A, C, connecting the lowest and highest points—divide in a number of equal parts equal to the difference of height between A and C. Through the point corresponding to the elevation of B draw B 11 and produce it—draw a line E, F, at right angles to B 11. The line E, F., divided as in the cut, and produced if necessary, is called the scale of the plane. It is nothing more than the line of greatest inclination of the plane crossing the contour lines at right angles and divided by them into equal parts.

We must bear in mind that only a plane can have a scale—that an irregular surface cannot.

whose upper base lies in the surface. That portion of this prism which lies above the cutting plane is required. It is evidently equal to the area $c'\ d'\ e'\ f'$ multiplied by the mean height of the four points $(c', d'\ 2)$, $(e', f', 3)$ above the cutting plane.

Knowing the scale according to which the diagram is drawn, it is easy to calculate the area of $c'\ d'\ e'\ f'$, and having the scale of the plane, the height of each of the points $(a', d', 2)$, $(e', f', 3)$ above it, can be readily found. From c' draw $c'\ c''$ perpendicular to the trace* of the plane, and if $\frac{m}{n}$ is the scale of the plane, $\frac{m}{n} \times c'\ c''$ is the height of the point in which the perpendicular through $(c', 2)$ pierces the cutting plane. Hence

$$2 - \frac{m}{n} \times c'\ c'' = \frac{2\ n - m \times c'\ c''}{n},$$ is the height of $(c', 2)$ above the plane.

Finding the height of each of the other points above the plane in the same manner, there results for there mean height above it,

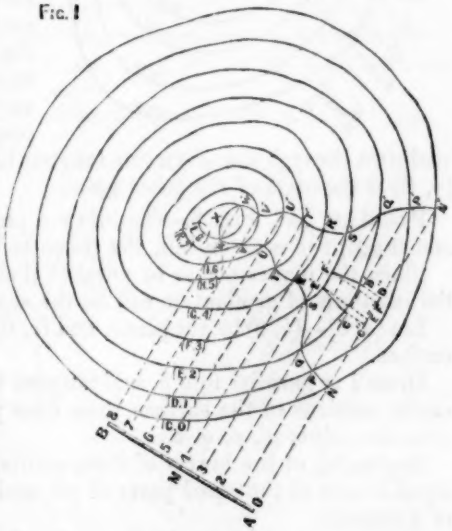
$$\frac{10\ n - m\ (c'\ c'' + d'\ d'' + e'\ e'' + f'\ f'')}{4\ n},$$

and for the volume of the truncated prism above the plane,

$$c'\ d'\ e'\ f' \times \frac{10\ n - m\ (c'\ c'' + d'\ d'' + 'e'\ e'' + f'\ f'')}{4\ n}.$$

Finding in the same manner that part of each of the elementary truncated prisms which lies above the cutting plane and adding them all together, their sum will be volume cut off by the plane.

Fig. 1



Of course this is only an approximate solution, and is more or less correct according as the horizontal planes which determine the scale of the cutting plane and the horizontal contour lines of the surface, are nearer together or farther apart, and as the chords of the elementary curves correspond more or less nearly with them.

If the curves are very near in space, the chords of the elementary portions of their projections may be regarded as parallel, and $c'\ d'\ e'\ f'$ will then become a trapezoid.

PROBLEM III. Fig. 2.—To draw a plane through a given line tan-

* The TRACE of a plane is its intersection with the plane of projection, and is of course a straight line lying in the plane of projection.

gent to a given hill, the plane to lie entirely above the surface of the hill.

Let $(a, 0)$—$(b, 6)$ be the line, and $(c, 0)$—$(d, 1)$—$(k, 6)$ the given surface.

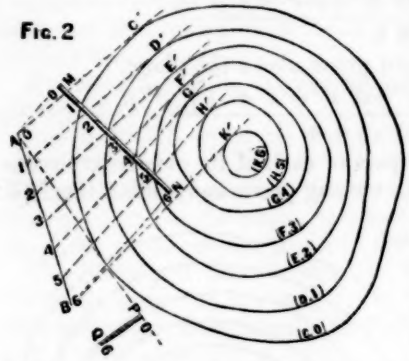
Through each point of division of the line draw horizontal lines tangent to the horizontal sections of the surface; $a\ e'$, $1\ d'$, $2\ e'$ and c., are their projections.

Then, the plane which passes through the given line, and that horizontal line whose projection makes the least angle with $a\ b$, (the angle being estimated from the projection towards the direction in which the line descends), is the required tangent plane, $a\ 5\ h'$ being the least angle, $5\ h'$ is the projection of a line of the required plane, and its scale will be perpendicular to $5\ h'$.

Drawing through a, 1, 2, 3, &c-, lines parallel to $5\ h'$, $(m, 0)$—$(n, 6)$ is the scale of the required plane.

It is evident that $(m, 0)$—$(n, 6)$ is a tangent plane; for if through m, 1, 2, &c., lines be drawn perpendicular to $m\ n$, none of them will cut the horizontal sections of the given surface, and one of them, $5\ h'$, is tangent to the section of the surface which lies in the same horizontal plane.

Fig. 2



It is also evident, that if planes be passed through the given line and the other horizontal lines which were drawn tangent to the horizontal sections of the surface, that they will all cut the surface. From a given point in the plane of a curve two tangents can generally be drawn to the curve; it follows, then, from the construction, that two planes can be drawn through the given line tangent to the given surface. $(p, 0)$—$(q, 6)$ is the scale of the other plane.

Problem IV. Fig. 3.—To draw a plane parallel to a given plane and tangent to a given hill, the plane to lie entirely above the hill.

Since the planes are to be parallel their scales will be parallel, and the intervals of graduation will be the same.

Let $(a, 0)$—$(b, 6)$ be the plane, and $(c, 0)$—$(d, 1)$—$(e, 2)$—$(k, 6)$, the surface.

Draw $l\ m$ parallel to $a\ b$, and tangent to the projections of the horizontal sections of the surface, draw lines perpendicular to $l\ m$, meeting it in the points m, p, q, &c.

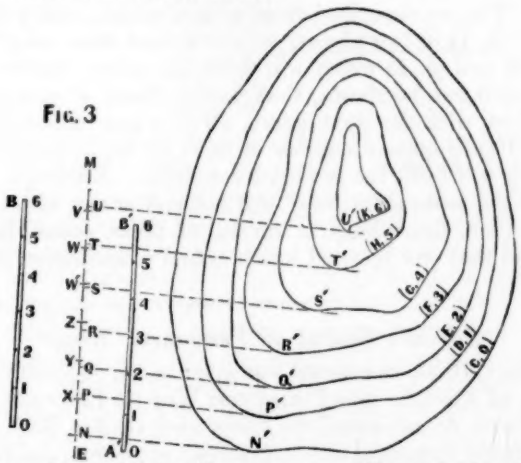
Beginning at the lowest of these points, lay off towards m distances equal to one of the equal parts of $a\ b$, and let x, y, z, &c., be the points of division.

These points will be in the scale of a plane drawn through $n\ n'$ parallel to the given plane, and will be at the heights 1, 2, 3, 4, &c., respectively.

But since this plane in rising from l to m, has a height (2) at the point y, it must pass below q, and therefore below $q\ q'$, and must cut the curve (e, 2), in some point. Hence it cannot be the required plane.

Commencing at p, lay off in like manner divisions equal to those of $a\ b$, and repeat the construction with respect to each of the points n, p, q, &c., until one is found from which the divisions being laid off all the points lie nearer to l than the corresponding points n, p, q, &c., at the same elevation. These will be the required points of graduation of the scale of the required plane. In the diagram, r is the point from which the divisions must be laid off.

FIG. 3

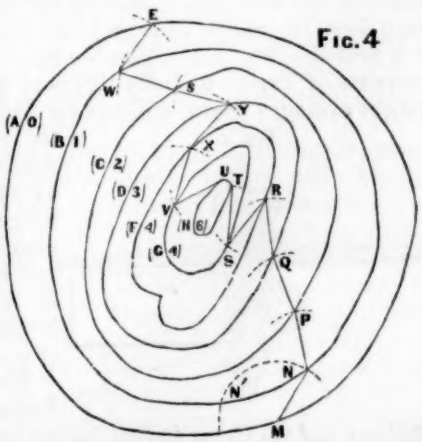


To avoid confusion in the diagram, a parallel to $l\ m$ has been drawn, and the scale is constructed on it. r' is the point of contact, and (a', 0)—b', 6 is the tangent plane.

PROBLEM V. Fig. 4.—To ascend a given hill with a given slope.

Let (a, 0)—(h, 6) be the hill, and $\frac{m}{n}$ the given slope. The secant planes being at the unit's distance apart, $1 \div \frac{m}{n} = \frac{n}{m}$ will be the length of the projection of that portion of the required line which joins any two adjacent contour lines, m being the point at which the ascent is to begin, with m as a centre, a radius equal to $\frac{n}{m}$ describe the arc of a circle cutting (b, 1) in m; in the same manner with n as a centre find p; then q, r, s, t, and $m\ n\ p\ q\ r\ s\ t$ will

FIG. 4



be the projection of the required line. If it is required to descend the hill so as to reach the bottom at a point as nearly opposite to m as possible, trace (h, 6) to u, and with u as a centre and the same radius as before describe an arc cutting (g, 5) in v; then find x, y, z, w, e, and $u\ v\ x\ y\ z\ w\ e$ will be the projection of the line of descent.

If the slope of descent should differ from that of ascent, the radius will be found by dividing 1 by the slope. The contour lines are supposed to be so near to each other that the surface between them may be generated by the motion of a right line resting upon both and remaining constantly perpendicular to one, or making equal angles with them both. The arc described from m as a centre, and a radius equal to $m\ n$ cuts (b, 1) in two places, m' and n, and there may be two lines joining (a, 0) and (b, 1) which will fulfil the given condition. In the same manner it can be shown, that having found n' and n, four lines may join them with the next curve, all of which will fulfil the given condition. Hence quite a number of lines, all beginning at m, may be drawn which will fulfil the required condition. Although these lines all begin at the same point, they will not end at the same. In a case of practice, then, these lines, or several of them, should be examined in detail, and that one selected which actual examination proves to be best.

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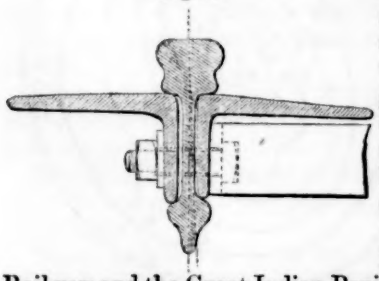
*Adams's System of Permanent Way.**

In February, 1856, an account was given in the pages of this *Journal* of a system of wrought iron Permanent Way for Railways, by Mr. W. Bridges Adams, denominated the Suspended Girder Rail. The testimony in its favor by several eminent railway engineers, and the practical experience since gained confirmatory of their opinions, together with its adoption for more than one important line, make it probable that this class of way will be ultimately preferred, wherever iron is considered imperative and timber inadmissible. Experiments are still going on to ascertain the minimum of bearing surface which will suffice, in order to keep down the weight and cost to the absolutely requisite quantity, and it is probable that a considerable reduction will be the result. For the purposes of export to India this is of great importance, as every ton weight averages thirty shillings for freight—about one-sixth added to the original cost of the materials. And wrought iron is in all structures a very considerable reduction of dead weight, with equal strength and greater security as compared with cast iron. The two sections hitherto applied are as follows:—Single-headed (Fig. 1) and Double-headed (Fig. 2).

Fig. 1.

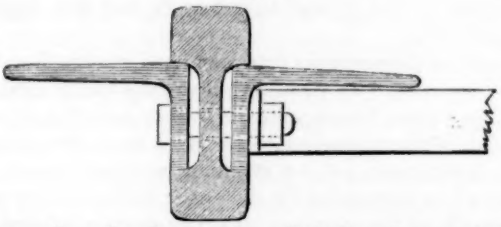


Meanwhile two of the highest Indian authorities—the East Indian Railway and the Great Indian Peninsular Railway—appear to consider

* From the Journal of the Society of Arts, No. 312.

the question of iron sleepers a most important point, judging from their half-yearly reports. The East Indian engineer states that the cast iron sleepers are a comparative failure, and that they are being removed into branch roads and sidings, and being replaced on the main line with timber sleepers. The Great Indian Peninsular engineer, on the

Fig. 2.



contrary, states that the destruction of timber sleepers is ten per cent. compared with five per cent. of the cast iron sleepers. In the absence of specific information as to the cause of failure, it is to be presumed that the failure of the cast iron is from breakage—a defect from which the wrought iron system is free—and the failure of the timber must be either from the white ant or from splitting by moisture and heat.

Structure has, no doubt, much to do with it, both in the case of iron and timber. A bad form of cast iron will ensure breakage even with a surplus amount of weight, and the mode in which timber sleepers are commonly used with double-headed rails, both in England and India, is not favorable either to the durability of the rails or timber.

The timber sleepers are usually ten inches in width, five inches in depth, and from nine to ten feet long. At each end of the sleepers is fixed down, by iron spikes or wood trenails, a mass of cast iron called a chair, now usually varying from 25 lbs. to 42½ lbs. each. In these chairs, the distance of which apart on the sleeper determines the gauge, are fixed the rails, the opening being sufficient to drop them in from above, and they are secured by wooden keys driven in laterally outside. The rail is composed of three members or portions, the lower table, the upper table, and the vertical web, which connects them together. The rail resting in the chair on its lower table acts as a prop to sustain the wheels. If the rails and chairs are always in contact, no blow will ensue, and when the upper table is worn out by work, it may be turned down, and the lower table will supply an unworn surface, with only the defect of a bad bearing in the chair, by reason of the worn surface of what was the upper table. But, practically, the running of the wheels causes lateral blows which crush the wooden keys, and the rails get loose in the chairs, striking a succession of hard blows well-known to passengers, crystallizing the texture of the rails, and destroying their upper surface by the blows of the wheels and their lower surface by blows on the chairs. All this is aggravated by the great elevation of the rails above the bearing of the sleepers on the ballast. The rail is five inches, the chair two inches, and the sleeper five inches, total twelve inches; thus any loosening of the wood key is aggravated by the height

of the prop, and a rocking motion ensues which disturbs the bearing of the sleepers, and in wet weather, lets in the water beneath them. To solidify the sleepers below, it is thus needful to dig out 12 inches of material to get at them, and this leaves loose ballast above when again filled in, which is disadvantageous in many ways. In this particular the wrought iron suspended girder is particularly advantageous. It is not requisite to open up the ground to get at it, and the upper surface is always firm and solid.

The principle of the wrought iron way, *i. e.*, suspending the rail from the upper table instead of propping it on the lower table, has, for a considerable time past, been applied to timber as well as to iron, and for those who think timber sleepers better than iron, the advantages, mechanical and economical, hereby attained, are very great. In the first place, as the rail is suspended by the upper table, it does not need one half the strength of the vertical web, but merely enough to hold the top and bottom tables together, as in an ordinary bridge girder. Consequently, weight can be saved in the rails, and at the same time their depth can be increased. An ordinary rail is five inches in depth, and as the strength of a beam is as the square of its depth 5×5 represent 25, whereas 6×6 represent 36, or one-half increase, and 7×7 represent 49, or nearly double.

In the side channels of these deep rails are bolted lateral timbers, four inches wide by four inches deep, by key bolts, three feet apart, making a total width of eleven inches. The rail is thus compounded of a central iron bar between two timber bars, which give it great lateral strength in addition to its own increased vertical strength.

The lower rails are connected together at the joints by brackets of wrought angle iron, bolted down to a cross-sleeper. If the rails are long, a central cross timber, four inches by four inches, is secured to the central key-bolts, and thus the gauge is secured.

In the ordinary cross-sleeper road there is a sleeper every yard, the full area of which is about seven and a half superficial feet, but the practical bearing is generally calculated at less than three-fourths. On the longitudinal plan the whole area may be reckoned, and therefore the area of the suspended plan is fully equal to that of the cross-sleeper plan, while the height of the rail is only four inches above the bearing, instead of twelve inches on the ordinary method.

When this plan was first proposed it was imagined that the small bearing surface of the rail on the timber by which it was suspended would crush in and destroy the timber; but calculation easily demonstrates the contrary. For instance, there are six chairs to an 18 feet rail; the bearing of each chair on the timber sleepers is about 48 square inches—total, 288. In the suspended method there is a width of three-quarters of an inch along each side of the rail, amounting to a total of 320 square inches,—and continuous.

But, it was argued, on the Great Western system of the bridge rail there are 1080 square inches in the same length, and yet it crushes into the timber. Quite true, but the reason is obvious. It is a shallow and not a deep rail, and it does not distribute its load over a long space

as does the deep rail. It crushes the timber in detail beneath the wheels.

The engineer of the North London Railway had faith in the system, and determined to lay down a few lengths on trial. The total width of the combined rail and lateral timbers was ten inches and a half, and the rails used were not deep, but the ordinary section of five inches—the total depth of the timbers being four inches. The rails were connected at the joints by cast iron angle brackets secured to cross-sleepers, and there was no intermediate tie, the length of rail being only fifteen feet. The result is given in the following report by the engineer:—

"The experimental length of the suspended rail laid on the North London Railway has now been down about twelve months. It was purposely placed in a situation exposed to the severest test which the line admits of, at the foot of a steep gradient, on a sharp curve, and at a station where numerous trains stop and pass through every hour.

"From the weekly reports furnished by the Company's inspectors, combined with my own occasional examination, I am able to state, with confidence, that the result of this trial has been very satisfactory in respect of durability and of economy. The original outlay is less than that required for the ordinary modes of construction, and the cost of manufacture is trifling, while the road is smooth and easy for the traffic."

On the North London Railway engines are used of thirty-five tons weight. Passenger trains are incessant, goods trains frequent, and with the exception that the speeds are not quite so great as on some other lines, it is one of the hardest worked lines in the world, and the use of brakes is very destructive. On the sample piece of line, the upper table of the rails being actually worn out, they were reversed, when the lower table was found as perfect as when new, and the timber was absolutely free from any wear or movement in those parts where the rail bore on it. When the bolts were taken out the timber remained fast in the recesses of the side channels, and it required force to get it out. It had become, as it were, cemented to the iron.

Since then, a portion has been laid down on the Eastern Counties line—the main line from Cambridge, near the locomotive sheds—where it has been examined by several engineers, and highly approved of. The movement is easier and smoother than on any other part of the line, though only the ordinary rails and not improved rails have been used, and the common sleepers cut down the middle have been used, instead of proper longitudinals.

We come, now, to the question of cost and comparison.

CROSS SLEEPER LINE.

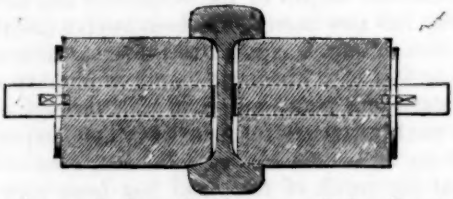
Quantities in a single mile.

		Tons.	Cwt.		£	s.	£	s.	d.
504 Rails, 21 feet long	70 lbs. per yard, 5 in. deep	110	0	at say	8	0	880	0	0
504 pairs Fishes	22 lbs. per pair	4	19	"	9	0	44	11	0
2016 Bolts		1	2	"	20	0	22	0	0
3520 Cast Chairs	28 lbs. each	44	0	"	5	0	220	0	0
7040 Spikes	1 lb. each	3	3	"	12	0	37	16	0
3520 Wood Keys				"	5	0	18	0	0
1760 Cross Sleepers creosoted	5 in.×10 in.×9ft., 4s. 6d. each	130	0	"			396	0	0
18864 Parts.		293	4				1618	7	0
	Freight to India at 30s. per ton,						439	10	0
							£2057	17	0

SUSPENDED RAIL ON TIMBER LONGITUDINALS.

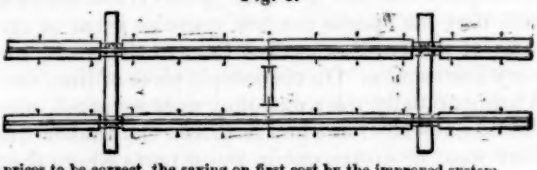
		Tons.	Cwt.		£	s.	£	s.	d.
504 Rails, 21 feet long	65 lbs. per yard, 6 in. deep	102	3	at say	8	0	817	4	0
504 pairs Angle Joints, 1 ft. 6 in. long	28 lbs. per pair	6	6	"	9	0	56	14	0
1008 Bolts for Angle Joints	1¼ lbs. each	0	13½	"	20	0	13	10	0
3520 Key bolts for timber	2½ lbs. each	4	0	"	12	0	48	0	0
1008 Angle Joint Spikes	1 lb. each	0	9	"	12	0	5	8	0
1008 Timber Longitudina's	5 in.×4 in.×19 ft. 6 in. 56 loads	42	0	"	3	10	Load 196	0	0
252 Cross Sleepers	5 in.×5 in.×9 ft., 4s. 6d. each	19	0	"	3	10	do. 56	14	0
252 Wood Ties	4 in.×4 in.×4 ft., 2 loads	1	12				7	0	0
8056 Parts		176	3½				1200	10	0
Freight to India at 30 s. per ton,							264	5	3
							£1464	15	3

Fig. 3.



The cross section and plan of the suspended rail are here given. It will be seen that to remove the rail it is not necessary to remove the timber, but only the joint bolts, both sides being alike. Fig. 3 is the cross section, Fig. 4 the plan.

Fig. 4.



Assuming these prices to be correct, the saving on first cost by the improved system in England is per single mile,	£417	17 0
In India, taking the difference in freight; there is a saving of	175	4 6
Total saving,	£593	1 6

With a rail of one-half more vertical strength.*

If the same principle of side bolting be adopted with cast iron sleepers in the strongest mechanical section, as Fig. 5, the cost per mile will be—

	Tons.	Cwt.		£	s.	d.
504 Rails	102	3	at £8	817	4	0
3520 Pairs cast Side Brackets	100	0	" 5	500	0	0
4024 Key Bolts .3 lbs. each	5	8	" 12	64	16	0
504 Tie Bars, 12 lbs. each	2	14	" 12	32	8	0
	210	5		1414	8	0
Freight to India 30 s. per ton				315	7	6
				£1729	15	6

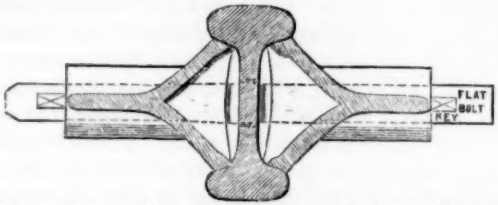
A sample of this has been applied on the South-Western Railway.

The saving in this mode as compared with the common system will be £326 0s. 0d. Cast iron can of course only be used in short lengths, and not continuously like wrought iron. The minimum ultimate cost of the wrought iron way is not yet ascertained, the reduction in scantling being still in course of experiment, but enough has been shown to

* The timber longitudinals may be applied in shorter lengths, break-joint if preferred.

induce those interested to institute a very searching inquiry into the whole matter.

Fig. 5.



In using the small scantling of timber, two obvious advantages arise,—lower cost of material, and greater facility for creosoting, if that process be applied. It will bring a simpler and cheaper class of timber into use for railway sleepers. This system is really lower in cost than the American system, which has been adopted from the temporary ways of English contractors, but with the advantages of a double-headed rail of less comparative weight, but really equivalent to two rails, the lower side remaining undamaged while the upper side is wearing out. And in addition to this there is a great saving in the depth of ballast.

The prominent distinction between the American system and the English system, is, that in England a double-headed rail is used, secured in a cast iron chair. The cost of these cast iron chairs, and their freight and transit rendered it necessary to dispense with them for poor lines, and in the absence of other knowledge, the double-headed rail was also dispensed with, and the flat bottomed rail of only half the service substituted for it. This new system of side bearers in the channels practically doubles the duration of the rails while diminishing the cost.

In considering the question of freight as an element in all distant Colonial lines when the material is supplied from England, India has been taken as affording the broadest comparison.

Russian Inland Navigation.

We are indebted to the *United States Railroad and Mining Register*, (Edited by Thomas S. Fernon, Esq., of Philadelphia,) for the following abstract from a very interesting account of the various systems of internal navigation, now in actual use in the Empire of Russia—Comprising *Canals, Slackwater Navigations, and River Improvements*—actuated or aided (in most cases), *by reservoirs of considerable magnitude.*

This comprehensive description has been derived mainly from official documents in the Russian language, and may (we understand) be fully relied on, *as authentic.*

The extensive and successful use which has been made of *Reservoirs* in that vast empire, not only to feed canals, but *rivers also*, cannot fail to be interesting to our readers, and may tend to remove from the minds of many, the objections which have been urged against the

employment of this grand and simple expedient, in improving the navigation of certain American rivers—or at least, may remove such objections as have been founded upon the idea that "*the Reservoir System of Improving Rivers*" was a new and untried plan.

While the great longitude and development of the Russian navigable systems, can hardly fail to excite surprise in this country, (where they are little known,) we cannot withhold our commendation of the skill and ingenuity evinced by the Russian engineers, not only in their choice of the most suitable materials in the various localities, but also in the admirable adaptation of the plans of their hydraulic works, to suit the circumstances of each case, so far as they can be gathered from the necessarily brief description before us.

This description of the RUSSIAN INLAND NAVIGATION, is divided into *three* chapters.

1. *On the artificial navigable communications leading towards St. Petersburg.*
2. *The artificial navigable systems* of the West of Russia.
3. The improvements made in the navigation of rivers.

In perusing these, we shall find strong evidence of a highly advanced state of the arts connected with hydraulics, and we may in this connexion, mention long lock chambers with *numerous sets of gates*, and *movable dams* in the rivers, as useful expedients, which in some places in our own country, it may be found advantageous to employ, to a greater extent than has yet been done among us.

I. *Systems of Artificial Navigation leading towards St. Petersburg.*

SYSTEM OF VISHNEY VOLOTCHOCK.—The navigation of the Vishney Volotchock system begins at the Volga, thence ascending the Tvertza river it passes by the Vishney Volotchock canal into the Zna,* and continues down the Zna and Msta to lake Tlmen. In order to avoid the necessity of passing through this lake with the boats and the floats, two canals have been constructed, called the canals of Sievers and of Vishera. On leaving these canals the loads enter the Volkhof river and continue their descent to Ladoga lake.

The construction of the Vishney Volotchock canal, between the Tvertza and Msta rivers, was commenced in 1703. The navigation between the Volga and St. Petersburg was first opened in 1710. This navigation encountered at first great difficulties, occasioned not only by the want of water, but also by the defective construction of the sluices and other hydraulic structures.

In 1719 the works of the Vishney Volotchock canal being found to be much decayed, the re-building of them was entrusted to Michael Serdionkoff, a citizen of Novgorod, who at his own expense removed the different hydraulic structures, deepened the canals and rivers, and established reservoirs. As a remuneration for the expense he was thus subjected to, he was allowed various privileges for the establishment of mills and also of drinking shops or taverns for the people engaged in the naviga-

* The name of Zna is given to the upper part of the Msta river as far down as its entrance into the lake Matino.

tion, and he was permitted to levy a certain toll upon the boats which traversed this system of navigation.

Serdionkoff improved the Vishney Volotchock system; at his death the administration passed to his heirs, who, in 1774, not desiring any longer to continue it, returned the control to the government.

The first improvement undertaken by the government consisted in the establishment of a lock, built of granite, at the exit of the river Msta from the lake Mstino; notwithstanding this improvement, the increase of the trade very soon demonstrated the insufficiency of the artificial resources of this communication.

The principal improvements in the Vishney Volotchock system were made in 1823 and 1826.

They consisted in the enlargement of the reservoir called the *Zavodsk reservoir*, situated in the vicinity of Vishney Volotchock, where a great mass of water is held in reserve, sufficient for all the wants of the most active navigation.

Among the more important improvements of this system must also be reckoned the establishment of elastic floats upon the Msta at the rapids of Borovitchi. These rapids extended for a distance of 20 miles, and in this distance the entire fall is 213 feet.

At the Borovitchi rapids the following difficulties are encountered in the navigation of the river:

A crooked channel between abrupt and stony banks, as well as stony capes or elbows, which project into the stream.

The bed of the river has a rapid inclination, and considerable shoals have been formed in it, which, together, produce violent eddies, and a great agitation of the surface of the water.

The bottom of the channel is uneven and stony, and the direction of the channel is very irregular, passing alternately from one bank to the other.

There are submerged bars covered with long stones brought and left there by the ice during spring floods.

There are bold vertical banks, which become separated from the main land in vertical layers, and threaten to fall into the river. There are islands in the channel of the river, which are not covered in a navigable stage of the water, and which separate the bed of the stream into several branches. With strong side winds, the barks are frequently forced out of the navigable channel into those which are not navigable.

The barks carried away by the force of the current, are often, in spite of all the efforts and skill of the boatmen, driven against the vertical banks and broken. It is for the prevention of such disasters, that the elastic floats have been established in the most dangerous places. The barks which strike against them rebound toward the channel without sinking, so that at present much fewer are lost than there used to be formerly.

At the present time the principal works of the Volotchock system are the following: A canal with a lock, built of granite masonry, between the Tvertza and Zna rivers. This canal is one mile and 4177 feet long and 70 feet broad at the bottom, the depth being about 8 feet.

The canal along the channel of the river Zna with two locks: one *in granite*, at the lower end, and the other *of wood*, built for the purpose of diminishing the consumption of water at the time the boats leave the canal. This canal is 3864 feet long, 70 feet broad, and two feet deep.

The Zavodsk reservoir is used part of the time in feeding the waters of the Tvertza, so that the fleets of barks *may ascend it* from Tver to Vishney Volotchock; afterwards the waters are turned into the lake Mstino and the Msta river *for the descent* of the same fleet of barks toward Novgorod.

The waste weir and flood-gates of Zavodsk reservoir, constitute one of the most important hydraulic works of the whole system. It retains in the reservoir a layer of water 17 feet in depth above the sills of the flood-gates, the superficial area of the reservoir being 14,873 acres.

In place of the old waste weir, the construction of which was rude and defective, and which was much out of order, the present new one has been built, which was finished in 1846.

In the plans for the new waste weir and flood-gates for the Zavodsk reservoir, every precaution has been taken for ensuring the stability of the structure and the resistance of the foundations, for, as has been stated, this is the important hydraulic work of the Vishney Volotchock system. The abutments and piers have been made of *wood*, not only for the purpose of diminishing as much as possible the expense; but most especially for the reason that repairs can only be made after the closing of navigation, that is to say, at the end of autumn, at which time the frosts of winter set in, and render repairs of masonry structures very difficult and uncertain, if indeed it is possible to execute them at all.

The granite lock of the Msta is placed at the head of that river where it leaves the Mstino lake, and where the boats and floats coming from Vishney Volotchock, are united into a fleet. The object of this lock is to retain the water which is drawn from the Zavodsk reservoir in the Mstino lake, as in a new reservoir, the influence of which in raising the waters of the Msta, is much more efficacious than that of the Zavodsk reservoir, on account of its greater proximity.

The Ossvuga reservoir is established near the Ossvuga river, where it empties into the Tvertza, and has a separate waste weir. The object of it is to assist in supplying the Tvertza with water while the fleet of barks is ascending it and to keep the flow of the stream regular.

The construction of a new waste weir was begun in 1842, and finished in 1843, so as to replace the one which previously existed, and which was in a very precarious state.

In selecting the position for the new waste weir of the Ossvuga, care was taken to avoid an inconvenience, which the old one presented, viz: that when the water was permitted to escape through the flood-gates, the current of the Tvertza, already very rapid, would augment considerably in velocity, and thus render the ascent of boats very difficult.

The reservoirs contiguous to the waste weirs of Doubkovka, Kametsk, Bairaizansk, and Ohversk, have been established for the Msta, with the same view as that of the Ossvuga for the Tvertza, that is to say, *to*

complete and regulate the supply of water from the great reservoir of Zavodsk.

The waste weirs of Ouversk and Doubkovka, have been built new, and that of Bairaizansk has been repaired as to its principal parts, in the years 1838, 1839, 1840, 1841.

The system of Vishney Volotchock, *where the navigation is fed by supplies of water artificially controlled*, is 400 miles long, from Tver to the commencement of the canal of the Vychera near the Msta.

For this distance the boats never navigate singly, but are united into fleets or caravans. Four fleets ordinarily pass in each year. About 4000 barks traverse this system annually, passing down the rapids of Borovitche and proceeding towards St. Petersburg. Their cargoes amount to about 514,286 tons gross.*

The vessels which are made use of for transporting cargoes on the Vishney Volotchock system, are principally arks, or flat-boats, 120 feet long and 28 feet wide, and conveying cargoes of from 100 to 130 tons. Their draft of water during the low stage of the rivers is about 21 inches, and in the spring as much as 24½ inches.

These vessels traverse the Vishney Volotchock system with considerably rapidity. The spring fleet, composed ordinarily of 1200 or 1400 arks, carrying from 177,000 to 193,000 tons, is occupied two months in going from Tver to St. Petersburg, a distance, by the water it takes, of about 666 miles.

Two canals, those of Sievers and of Vychera have been constructed for the passage of the arks from the Msta into the Volkhov, without entering lake Tlmen.

The canal of Novgorod, or of *Sievers*, was made for avoiding lake Timen, between the mouth of the Msta river and the commencement of the Volkhov river.

It was begun in 1797 and opened for navigation in 1804.

It is established on the same level with lake Tlmen, and consequently has no locks. It is 5·65 miles in length; its breadth on the bottom is 70 feet; and boats can traverse it with a draft of water equal to 5 feet. The canal begins on the Msta 6 miles from its mouth, and passing through low grounds, which are submerged by the spring floods of the lake, it ends at the outlet of the Volkhov river.

The canal is consequently liable every year to be obstructed with alluvial deposits, which render its navigation difficult in the spring during the prolonged inundations of the Tlmen.

These inconveniences of the Sievers canal, joined with the stoppages to which the arks are liable at the point where they leave the canal to enter the Volkhov, having induced the government to construct between the Msta and the Volkhov another canal now called *the Vychera canal.*

The Vychera canal has therefore also been constructed for the purpose of avoiding the Tlmen lake, and it passes from the Msta to the Vychera, which falls into the Volkhov river.

It was begun in 1826 and opened for navigation in 1836.

It has no locks, but it is closed at the end next the Msta *by a movable*

* In all cases the ton spoken of is the gross ton of 2240 pounds.

dam or waste weir, with granite sluice with abutments and moveable planks, which are put up for a short period in the spring for the purpose of preventing the spring flood, which occurs sooner in the Msta than in the Volkhov, from passing through it. The canal is 9¼ miles long and its breadth on the bottom is 38 feet.

The canal commences at the borough of Bronnitzy on the Msta, 16 miles from its mouth, and ends at the Vychera, which falls into one of the branches of the Volkhov, called the little Volkhovets. In consequence of the clayey texture of the soil, the banks of the canal have been revetted.

The breadth of the Vychera canal does not permit the arks to pass each other. In determining the dimensions of the canal, they were made as small as possible for the purpose of diminishing the amount of earthwork, having in view the fact, that by far the greater part of the arks which were to traverse the canal would pass from the Msta towards the Volkhov. But there are also boats, though very few in number, which go from the Volkhov to the Msta, and in order that they may not interfere with the movements of the fleets, *small side basins* have been dug in the bank of the canal, where these boats can stop so as to leave the middle free. Boats can navigate the Vychera canal with a draft of water of 3 feet.

The canals of Sievers and Vychera, have therefore both been constructed for the same purpose, that of avoiding the necessity of entering lake Tlmen with the arks, which thus are enabled to pass from the Msta into the Volkhov and down the latter stream to Ladoga lake.

Ladoga lake is stony and its bottom is covered with large stones; with head winds the navigation is tedious and even dangerous. Moreover the vessels on the lake do not navigate the Vishney Volotchock system, and the arks, which arrive at the Ladoga by the Volkhov, cannot, in consequence of the manner in which they are constructed, continue their navigation upon the lake. For these reasons the Ladoga canal has been built, for the purpose of enabling boats to pass from the Volkhov into the Neva, without entering the lake.

The vessels, which pass through the systems of Vishney Volotchock, Tykvine, and Marie, all pass through the Ladoga canal to reach the Neva, and for this reason the description of this canal should come after those of the three systems.

(To be Continued.)

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*Cornish Engines.**

The number of pumping engines reported this month is 16. They have consumed 982 tons of coal, and lifted 7,400,000 tons of water ten fathoms high. The average duty of the whole is therefore 51,000,000 lbs. lifted one foot high by the consumption of 112 lbs. of coal.—*Lean's Engine Reporter, 23d November.*

* From Herapath's Journal, No. 1017.

AMERICAN PATENTS.

List of American Patents which issued from December 14, 1858, to January 11, 1859, (inclusive,) with Exemplifications.

DECEMBER 14.

50. Stencils; Robert A. Adams, St. Louis, Missouri.

Claim—The preparation of the "stencil" blank, in the manner described, to wit: in oil shellac and glue, applied as set forth; also, the application of the sand or emery to the back of the "stencil," in the manner described.

51. Sewing Machines; J. E. Atwood, Mansfield Centre, Connecticut.

Claim—The combination of the vibrating arm which carries the dog, its attached arm, the swinging frame, the independent levers, the springs, and the cam.

52. Wrist-band Fastener; Daniel S. Baker, Providence, Rhode Island.

Claim—The spring firmly attached to the front of the fastener in its application to the heel, by means of a shoulder and the end, in such manner as to form a perfect fastener, and easily operated upon.

53. Sewing Machines; Amos H. Boyd, Saco, Maine.

Claim—The combination of the looper, the bars, B and C, and cam wheel, when constructed as described.

54. Stoves; John S. Clark, Philadelphia, Pennsylvania.

Claim—The movable plate as it is arranged with, and has relation to, the grate, the usual back plate, the air passages, and the passage for the products of combustion, as set forth.

55. Stoves; John S. Clark and Washington Harris, Philadelphia, Pennsylvania.

Claim—Combining with the adjustable air passages at the top of the interior cylinder or lining, the section of the hollow annulus with perforations, its lower edge resting upon the inner edge of the lining, and its upper edge against the shell plate, and thus forming an air chamber, as set forth.

56. Tea and Coffee Pots; Stephen Culver, Newark, New Jersey.

Claim—1st, The leach, composed of the receptacle, the canister, and the tube or siphon. 2d, The combination of the reservoir with the leach. 3d, The diaphragm with the steam orifice, and the combination thereof with the receptacle of the leach, in the manner described.

57. Excavators; S. S. Curtis, Croton Corners, New York.

Claim—The combination of the eccentric scoop with the adjustable gauge-stops and braces, or their equivalents, arranged in the manner set forth.

58. Railroad Brake; Wm. Edge, Downingtown, Pennsylvania.

Claim—The application to railroad cars of a vertical self-acting safety car brake, consisting of a flanched safety block, cam wheel, axle, lever, chains, connecting rods, bumper, wheel block, pedestal, and shafts, combined as described.

59. Air Engines; John Ericsson, City of New York.

Claim—1st, The system of levers, rock shafts, and connecting rods, or its equivalent, for combining the supply and working pistons with the crank shaft of the engine, to produce the operation specified. 2d, The ring, the notches, check pins, and the elongation of the supply piston, or their equivalents, for effecting the required transfer of the air to and from the heater, and the cooling of the cylinder and preservation of the packing of the working piston. 3d, The telescopic tube applied within the working cylinder and its prolongation, by means of which tube the air is brought in proper contact with the heating surfaces.

[This invention consists in so constructing, arranging, and actuating the supply and working pistons, within a single cylinder, that the cold supply air in being transferred to the heater for the purpose of having its tension augmented, shall cool that portion of the cylinder in which the working piston moves, and keep it at so low a temperature that any kind of metal, or any other suitable material, such as leather, may be employed to keep the piston air-tight. In order to effect this, the working and supply pistons are connected to the crank of the fly-wheel shaft by a system of levers, rock shafts, and connecting rods, of such a nature that an alternating, accelerated, and retarded reciprocating movement will be imparted to the two pistons, capable of effecting the desired transfer of the air and cooling of the working cylinder, and at the same time to produce motive power. The invention further consists in placing the heater within the working cylinder, or a prolongation thereof, and in conveying the supply air from the cold end of the cylinder to the opposite end by such means that every particle of the air to be heated is made to traverse the entire length of the heater.]

60. Car Seats and Couches; G. W. Fairfield, Holyoke, Massachusetts.

Claim—The combination of the flexible backs with the curved grooves and the sliding beam, so that the backs may be brought into a horizontal position.

61. Water Wheels; John H. Fairchild, Jericho, Vermont.

Claim—The single wheel, in combination with the draft tube, said wheel being placed within the penstock, and arranged either horizontally or vertically with said tube. Also, the annular gate placed within the sliding frame in connexion with the adjustable plate, arranged substantially as described.

62. Feed Water and Blow-off Apparatus for Steam Boilers; Jacob Frick, Philadelphia, Pennsylvania.

Claim—Combining an air vessel, having cocks and branches, arranged with the feed and blow-off apparatus, for which Letters Patent of the United States were granted to me on March 18, 1856.

63. Compositions for Tanning Leather; Wm. W. Gaige, Rochester, New York.

Claim—The use of salt and sal-soda in the proportion specified for a preparatory liquor. Also, the combination of starch and catechu in the proportion specified, for the second or first tanning liquor. Also, the combination of starch, catechu, and saltpetre, in the proportion specified, for the third liquor. Also, the combination of starch, catechu, and alum, in the proportion specified, for the fourth liquor.

64. MACHINE FOR MAKING HOLLOW BULLETS; Richard Gornall, Baltimore, Maryland.

Claim—1st, The employment, in combination with a punch and a set of dies, or their equivalents, for pressing blanks or pieces of lead into a form approximating more or less to the desired form for hollow bullets of a revolving core, serving, firstly, to produce the cavities in the bullets, and, secondly, as a mandrel to revolve them, for the purpose of finishing their exteriors by turning them. 2d, The employment, in combination with the revolving core, of a turning cutter operating automatically. 3d, The employment, in combination with the revolving core and turning cutter of a female centre, operating substantially as described, for the purpose of securing the bullets on the core during the turning operation, and liberating them after such operation.

65. STEAM AND WATER ALARM GAUGE FOR STEAM BOILERS; George W. Grader and Benjamin F. Cowan, Memphis, Tennessee.

Claim—The combined arrangement of the two valves, F I, and their seats, the several chambers and passages, the valve levers and their connexions within the case, A, substantially as described, whereby the construction of the instrument is rendered simple, its form compact, and its size limited without the use of stuffing boxes, or any packing.

66. MACHINERY FOR FORMING HAT BODIES; Michael Hardy, City of New York.

Claim—Combining a pervious cone, connecting with an exhausting apparatus, a picker or brush of a conical form, substantially as specified. Also, in combination with the pervious cone and conical picker or brush, the apron formed and mounted as described, for supplying fur to the several parts of the length of the picker in proportion to the diameter. Also, in combination with the pervious cone and conical picker or brush, the employment of a series of rollers forming a concave to direct the fur toward the cone. Also, in combination with the two cones, the one on which the hat is formed, and the other fitting over the hat, the tube connected with the exhausting fan and adapted to receive and hold the outer cone, to effect the transfer of the hat of fur fibres from the inner to the outer cone, as set forth.

67. STEAM RADIATORS; John Henry Holt and Josiah H. Gerould, Chicago, Illinois.

Claim—The combination of the wire gauze burner and its vapor hood applied to the self-acting boiler, connected as described, with the steam condensing cylinder and its reservoir, air cocks, and safety and vacuum valves, and its tubes and radiators, M, with their ends open to the apartment to be heated, and governed by the gas regulator; which combination produces a new and improved self-acting and self-regulating apparatus for raising the temperature of any given apartment in which it may be set up by radiation from surfaces heated by condensation of steam generated by the flame of combustible gas.

68. HARNESS SNAPS; B. B. Hotchkiss, Sharon, Connecticut.

Claim—Securing the spring to the snap hook by means of a collar so constructed and applied as to press against the broad end as well as the faces of the spring.

69. CAR BRAKES; Joseph Hough, Buckingham, and Jacob Moore, Hart, Pennsylvania.

Claim—The arrangement and combination of the slides and levers, as described.

70. CAR SPRINGS; Charles R. Hurlburt, Seymour, Connecticut.

Claim—The combination of the two kinds of disks, plane and raised with the rings, when the whole is constructed and arranged substantially as described.

71. BANDAGES; N. Jensen, Washington City, D. C.

Claim—Forming instruments of two wire springs, a and g, the spring, g, which supports the bag, being hinged and hooked to the other spring, a.

72. FOLDING TABLE; Charles Lammrich, City of New York.

Claim—The folding legs, combined with and hinged on to the bed or top of the table, in the manner specified.

73. SLED BRAKE; Albertus Larrowe, Cohocton, New York.

Claim—The arrangement of lever, scrapers, and rods, operating as described, for the purpose of a self-acting brake, and self-relieving and backing the sled.

74. ENGINE HOSE; Charles Lenzman, Brooklyn, New York.

Claim—The hempen hose woven, saturated, and covered, as described.

75. FOLDING CHAIR; R. McG. Lytle, W. G. Alston, and Lorenzo W. True, Williamson Co., Tennessee.

Claim—1st, The arrangement of the arms and also of the back, so that the back retains the arms in place when folded. 2d, The arrangement of the legs so that one set of legs folds over and retains the other set in place. 3d, The combination of the slotted bolt with the socket plate and spring stop, arranged for connecting the arms with the seats. 4th, In combination with the side bars, the screw strap, or its equivalent, for connecting the bars with the legs, so that when folded between the legs, one is raised and the other depressed for the purpose set forth. 5th, Connecting the legs with the seat by means of a socket joint, arranged so that each pair of legs can be withdrawn from their sockets and folded down, without being disconnected from each other or from the seat.

76. SHOWER BATHS; Joseph Mansfield, Jefferson, Wisconsin.

Claim—A shower bath having chambers, tubes, and stop-cocks, substantially as described.

77. BREECH-LOADING CANNON; Edward Marshall, City of New York.

Claim—1st, The employment of the adjustable chucks, constructed in the manner set forth. 2d, The recesses made from the outside of the gun into the bore, for the purpose of containing and concealing the chucks. 3d, The combination of the chucks with the pin, constructed substantially in the manner described. 4th, The arrangement of the pin, the collar, and the screw, substantially in the manner specified. 5th, The employment of projections for the purpose of securing and concealing the handles of the can.

78. CHILDREN'S CARRIAGE; Gilbert Maynard, Greenfield, Massachusetts.

Claim—Connecting the axle with the tongue by means of the peculiarly formed rods, which also serve as springs for the vehicle, as described.

79. STAIR SWEEPER; F. H. Moore, Boston, Massachusetts.

Claim—1st, The combination of the box and brush with the dust-pan, arranged as described, whereby the dust is prevented from escaping, 2d, And in combination with the above, the curtain, operating in the manner specified.

80. MACHINE FOR TURNING IRREGULAR FORMS; Z. F. Nance, Richmond, Virginia.

Claim—Passing the piece to be turned through the pattern, and the combination of the same with the swinging frame and parts connected therewith, as set forth.

81. STEAM BOILERS; Charles J. C. Peterson, Davenport, Iowa.

Claim—Arranging the feed pipe in such a manner under the fire-box, that the same, in combination with plates, placed between the bends of the feed pipe, constitutes the bottom of the ash-box, so that the feed water running through the pipe is heated by the ashes, said plates being so arranged that they can be raised and actuated by cranks and levers, so as to leave room for the ashes to escape.

82. ADJUSTABLE CARRIAGE SEATS; Henry H. Potter, Carthage, New York.

Claim—Attaching the seat to the body of the vehicle, as shown, or in any equivalent way, so as to admit of the seat being turned obliquely with the body, either to the right or left, for the purpose set forth.

83. ESCAPEMENT FOR TIME PIECES; George P. Reed, Roxbury, Massachusetts.

Claim—The improved escapement as constructed with its two impulse cams, or a double impulse pallet applied to the balance wheel axle, and to operate with the escape wheel, in combination with the double detent lever, lifting reverse cams or pallet applied to the detent lever of the escape wheel, and operated by a cam screw, or its equivalent, supporting the axle of the balance, essentially as explained.

84. STEAM GENERATORS; Robert E. Rogers, Philadelphia, Pennsylvania.

Claim—1st, The arrangement of the coils, constructed as described, the one being concentrically within the other, the annular spaces between the successive coils constituting direct and separate, and the only passages and outlets for the products of combustion, the entire lower portion of every coil having fire underneath it. 2d, The arrangement of the feed water pipe and the air feeding pipe in relation to each other and to the generating coils, whereby I am enabled to introduce the water in graduated quantities into the upper part of the coil, and use atmospheric air to force the water over or upon the heated surfaces. 3d, Imbedding the lower portion of each of the concentric coils in cast iron, cast around it to a greater or less height, for the purpose of protecting the coils from high degrees of heat.

85. FURNACES FOR EVAPORATING SUGAR JUICES; F. Roy, Parish of St. Bernard, Louisiana.

Claim—The setting of sugar kettles with the system of radial braces, so situated as to divide the space around the kettle into two apartments, communicating by the openings, when these upper chambers communicate with each other and by flues with a common flue, the whole operating as set forth.

86. FORCEPS FOR FASTENING CLASPS ON HOOP SKIRTS; George D., Samuel A., and Charles S. Russell, Birmingham, Connecticut.

Claim—The pliers having their jaws provided with recesses and lips, and with a lever or wedge-like attachment to operate in combination with the said lips.

87. BEE HIVES; Joseph D. Sanderson, Stetson, Maine.

Claim—The holes in the back of the hive communicating with the grooves in the doors, and the grooves in the under side of the top of the box, in connexion with the boxes provided with perforated plates, whereby the hive is perfectly ventilated, and the rain excluded.

88. GAS BURNING STOVES; Thomas Shaw, Assignor to self and C. S. Patterson, Philadelphia, Pennsylvania.

Claim—1st, The inverted cone, when arranged within and in respect to the hollow cylinder, and connected to the gas pipe, substantially as set forth. 2d, Extending the gauze disk beyond the opening for the passage of the gas, and so arranging the overhanging portion of the said disk that it shall be exposed to the air. 3d, The construction of the oven, consisting of the inverted box, its opening, and lining, and the inner cylinder, the whole being arranged to form the intervening passages, for the purpose set forth.

89. HARVESTERS; Oren Stoddard, Busti, New York.

Claim—The conical rollers, two or more, attached to the finger bar, in connexion with the sickle bar provided with an inclined back, and the cap plate, or its equivalent, the whole being arranged as set forth.

90. NUT MACHINES; Julius B. Savage, Southington, Connecticut.

Claim—The employment or use of the cutter, dies, and punch, in connexion with the conveyors, adjusters, and the jaws, or their equivalents, arranged as set forth.

91. WATER GAUGES FOR STEAM BOILERS; Thomas Stubblefield, Columbus, Georgia.

Claim—The combination of a float, a secondary valve, and a main valve, as set forth. Also, the method of preventing a too sudden opening of the main valve by insulating (in a chamber, or its outer side, exposed to the air) a quantity of steam.

92. ATTACHING CARRIAGE THILLS TO AXLES; John W. Sibbett, Cincinnati, Ohio.

Claim—The plate and socket or tube attached to the clip, in connexion with the pin attached to the thill, and the hook provided with a shank, and nut, and ratchet, the shank of the hook being fitted in the tube, and the ratchet having a pawl catching into or engaged with it, as set forth.

93. FLUID METRES; Charles Wm. Siemens, London, England; patented in England, March 4th, 1853.

Claim—1st, The construction of rotary fluid metres with a revolving wheel or drum, having tangential or oblique apertures, and connected with a counter, and inclosed in a fluid-tight case, and so arranged that the fluid to be measured flows from the centre towards the circumference of the wheel or drum. 2d, The application to rotary fluid metres of retarding vanes, substantially in manner described. 3d, Constructing the revolving part or wheel of a fluid metre and the fixed part or pipe which introduces the fluid into it, with two or more collars or flanches on one or both of the said parts, so as to check the passage of the fluid by the producing of eddies. 4th, Supporting the wheels or revolving parts of fluid metres by means of a flat or hollow plate or cap of steel, or other suitable material, attached to the wheel, and resting upon a fixed pivot, and combined with an oil chamber. 5th, Constructing fluid metres with a revolving wheel or drum having tangential or oblique apertures and retarding vanes, and provided with an oil chamber and pivot, and connected to a counter, and inclosed in a fluid-tight case. 6th, Constructing fluid metres with a dirt-box or strainer, arranged so that it may be opened and the dirt removed without disturbing the metre or the pipes. 7th, Constructing fluid metres with the wheel work, or a portion of the wheel work, of the counter, inclosed in an oil chamber which is exposed to the pressure of the fluid in the metre, substantially as described.

94. CULTIVATORS; Thomas Turner, Marysville, Ohio

Claim—The combination of the pulverizing mould board and hilling mould board, constructed as shown, and attached respectively to the longitudinally and laterally adjustable beams.

95. Adjustable Cradle for Dry Docks and Marine Railways; Washington Van Dusen, Philadelphia, Pa.

Claim—The combination and arrangement of the cradle bars, jointed, connecting, and sliding bars, chains, and sliding lifting screw blocks, respectively connected together and to the cradles, frames, or ribs, in such manner and in such relation to each other as to enable the cradle bars to be adjusted to the bilge of the vessel desired to be hauled up, and to sustain the same by operating the lifting screws, on one side of the cradle frames.

96. Slide Valve Gear of Steam Engines; Elijah Ware, South Boston, Massachusetts.

Claim—The combination of the single eccentric having a short eccentric rod, the fulcrum plates carrying a fulcrum pin, having a connexion with the short eccentric rod, the slotted frame receiving the fulcrum pin, and a pin on the eccentric rod and the slotted plate receiving a pin, or its equivalent, attached to a rod connected with the valve.

97. Lock; Charles S. Westcott, City of New York.

Claim—The ungearing of two sets of wheels when a lock is unlocked, in such a manner as to allow the slotted wheels which receive the tongue of the bolt to remain stationary while the remaining wheels can be turned to any desired position, so that the combination can be changed through the key-hole from the front of the lock, said ungearing being effected by means of a bar, or its equivalent, acting upon a movable piece of metal which supports the shaft upon which one set of wheels revolve, said bar being moved by the action of throwing the bolt, so as to throw one set of wheels out of gear with the slotted wheels when the lock is unlocked, and bring them into gear again when it is locked.

98. Apparatus for Operating Valves of Steam Engines; Norman W. Wheeler, Brooklyn, New York.

Claim—Actuating the cut-off valves of steam engines by means of an eccentric, or its equivalent, when the motion of the main valve is derived from the same eccentric, or its equivalent, but modified by a movement derived directly from a reciprocating part.

99. Valve Gear of Steam Engines; John L. Whetstone, Cincinnati, Ohio.

I do not wish to be understood as limiting myself to the precise arrangement or combination of parts, as described, but will vary them as circumstances may require, while at the same time I accomplish the same ends by means substantially the same, as, for instance, a sliding plate valve or a piston valve may be used instead of the rotating valve herewith shown; and in that case, if preferred, a forked arm may be attached to the rod which operates the cut-off valve, and the adjustable radius bar may be operated in the forked opening so as to give the cut-off valve a similar varying intermittent motion as that described. Or the arrangement of the parts may be reversed, as, for instance, placing the forked lever or arm on the rod or rock shaft which operates the main valve of the engine, and communicating motion to the cut-off valve therefrom through an adjustable radius bar, similar to that described; and, if desired, the governor may be made to operate the cut-off and throttle adjustments by a direct attachment of rods and levers to the rotating disk, or an equivalent device, without the worm wheel arrangement.

Claim—1st, Operating the cut-off valve by means of a forked arm or lever which is actuated by means of an adjustable radius bar which derives its motion from the rock shaft or from the eccentric which operates the main valves of the engine. 2d, Adjusting the radius bar by the variations of the speed of the governor, by means of a rotating disk operated by a worm wheel, said worm wheel being in such relation to the governor that when the governor is running at its right speed, no motion is communicated to the same, but when the governor runs either too fast or too slow, the worm wheel is turned in one direction or the other, and the radius bar is raised or lowered so that the cut-off is effected sooner or later. 3d, Operating the throttle and cut-off valve adjustments in combination, in such manner that the throttle valve is moved slowly, and is not closed to any considerable extent, while at the same time the cut-off adjustment is moved rapidly, and on the other hand, when the cut-off adjustment is in position for the shortest period of admission of steam, the movements of the throttle valve are the most rapid, the whole being accomplished in the manner substantially as described.

100. Valves of Steam Engines; H. D. Wicks, Flint, Michigan.

I am aware that it is not new to have a valve constructed so as to serve as a steam chest. But I am not aware that the steam has been admitted to such valves in any other manner than from above the ports, which mode of admitting the steam subjects the valve, while operating, to a downward pressure, that causes it to bind on its seat, whereas, by admitting the steam from below the ports, the valve is subjected to an upward pressure, and thus is relieved from bind and wear while operating. I do not claim, broadly, so making a valve that it shall perform the office of a steam chest. But I

Claim—The valve having the ports and cavities, and suspended between screws, in combination with valve seat having the cavity or port, substantially as and for the purposes set forth.

101. Machine for Drilling Metals; Robert Wilson, Milton, Pennsylvania.

Claim—1st, The adjustable inclined plane, for the purpose of increasing and decreasing the feed of a hand or power-drilling machine for all kinds of metal. 2d, The peculiar construction of the self-acting feed escapement combined with the adjustable inclined plane, for the purpose of throwing off and on the feed to suit any depth of hole within its entire descent, and then return again only to the height required within its ascent. 3d, The adjustable bearing against which the lower end of the feed hand rests, in combination with the involute or scroll, and the feed hand which works upon it, for the purpose of producing a safety adjustable self-acting pressure escapement.

102. Fire Escape Ladder; John Withers, Collinsville, Illinois.

Claim—1st, The combination of the canvass bag or shoot with the ladder, A, in the manner described. 2d, The combination of a bed and its frame, arranged to open and close, as set forth. 3d, The arrangement of the two ladders, A and B, with each other, and also the means of adjusting the ladder, B, substantially in the manner described.

103. Breech-loading Cannon; Edward S. Wright and Theodore P. Gould, Buffalo, New York.

Claim—1st, A mortise made through the breech of a cannon, in combination with the sliding abutment. 2d, The expansive chamber, or its equivalent, in combination with the cannon and sliding abutment. 3d, The application of a wrought iron band shrunk around the breech of a cannon, when the same is combined with a mortise and sliding abutment, as set forth.

104. Machine for Cutting Soap; Wm. B. Manning, Assignor to self and L. H. Olmsted, Oswego, N. Y.

Claim—The machine described for converting block and slab soap into bars and cakes, consisting substantially of the frame or series of cutters, the guiding and supporting bars, and the presser or follower.

105. Raking Attachment to Harvesters; Joseph Young, Marshallton, Pennsylvania.

Claim—The arrangement of the rake bar, shaft, and rod, provided with friction roller, jointed connecting rods, attached to crank pulley, inclined adjustable plate, spring, and nut, substantially as set forth.

106. LAMPS; Nathaniel Cradit, Ripley, Ohio, Assignor to Chester G. Robinson, South Reading, Mass.

Claim—1st, The described, or equivalent arrangement, of draft passages, communicating with the oil reservoir and central tube, conducting the air and gases from thence to the interior of the wick. 2d, The box and shell, in the described combination with two rectilinear sets of wick elevating pinions, or their equivalents, by which two flat wicks are converted into one circular wick.

107. HEELS FOR BOOTS AND SHOES; Samuel Flint and Robert S. Rodgers, Assignors to Wm. F. Johnson, Lynn, Massachusetts.

Claim—An improved manufacture of heel made of wood and india rubber, combined and arranged together substantially as set forth.

108. FILE-CUTTING MACHINE; George W., Assignor to self and D. S. Fogg, South Dedham, Massachusetts.

Claim—1st, Controlling the opening of the regulating valve of an atmospheric trip hammer employed in a file-cutting machine, for the purpose of regulating the blow thereof, and producing a uniform depth of cut from end to end of the file, by means of a pattern whose form corresponds with, or has a proper relation to, the longitudinal profile of the file blank, applied and operating upon the said valve, substantially as described. 2d, In combination with the arrangement of the cutter guide block at a greater inclination from a vertical plane than the hammer stem, and with the fitting of the cutter or cutter stock loosely in said guide block—I claim the employment of a clamping piece, or its equivalent, applied to the said guide relatively to a proper bearing on the opposite side of the cutter, and operated substantially as described.

109. APPLYING GAS FOR HEATING AND ILLUMINATING PURPOSES; Calvin Pepper, Assignor to self and J. G. Treadwell, Albany, New York.

Claim—Passing coal or other inflammable gas, alone or in admixture with atmospheric air, through a stratum or mass of silicious sand without aggregation of particles to be inflamed at the surface, substantially as described, for heating purposes, and also for illuminating, as incident thereto, as described.

110. PLOUGHS; Thomas Wiard, Assignor to G. W. and H. W. Pitken, and W. L. P. Wiard, Louisville, Ky.

Claim—The standard with its permanent wing and recesses or shoulders, for the reception of the removable wing, constructed and arranged substantially in the manner set forth. Also, in combination with the standard, constructed as set forth, the adjustable cutting and guiding wheel, so that said wheel may be thrown into or out of action, as the circumstances of the case may require. Also, the uniting of the handles, beam, and standard together, by means of the pockets, dowels, recesses, and bolt, substantially in the manner described.

111. SLIDE VALVE GEAR FOR OSCILLATING ENGINES; Wm., Assignor to Richard Stephens, Old Forge, Penna.

Claim—1st, The combination of the two independently operating sliding bars and the levers, the former sliding bar being connected with the valves rock shaft, and furnished with fixed or adjustable stop pieces, and the latter being connected by an arm with the cylinder trunnion, and the whole operating to produce the motion of the valve or valves. 2d, Combining the stop-pieces with the sliding bar, by fitting them to slide in slots in the said bar, and attaching them to a double slotted wedge applied to the said bar, for the purpose of adjusting or varying the lead of the valve or valves.

112. STEAM BOILERS; I. C. Stern, Assignor to George W. Stone, Philadelphia, Pennsylvania.

Claim—The application to locomotive boilers of the arrangement of tubes described, that is to say, the arrangement of the coil, b, or its equivalent, on the inside and on one side of the fire-box, and the coil, b', or its equivalent, on the opposite side, when one coil communicates with one pump, and the opposite coil with the other pump of the engine, and when the opposite coils are connected together by the pipe, d, so that the cold water direct from the pumps may pass into the coils, and thence in a heated state into the boiler, and so that the water may, at all times, circulate through both coils, as set forth.

113. LAMP SHADE SUPPORTERS; Wm. F. Shaw, Boston, Massachusetts.

Claim—The lamp shade supporter, with its upper and lower springs constructed of a single piece of metal, in the manner specified.

114. STRAW CUTTERS; Olive Ann Brooks, Somersworth, administratrix of the estate of Lebbeus Brooks, deceased, late of Great Falls, New Hampshire.

Claim—Two cutting knives or shears, or their equivalents, and so that, while one of them, when the machine is in operation, shall have a compound motion, whereby its cutting edge shall be made to move in an elliptical path toward and away from the trough, the other shall have only a reciprocating motion in a circular arc toward and away from the said trough, the lever frame carrying the lower knife or bed, being made to turn on a fulcrum rod, or its equivalent, and to be connected with the upper knife by means or mechanism essentially as described. Also, the application to the upper knife having a compound motion of a toothed rake, to operate therewith and facilitate the feeding of the straw forward in manner as specified]

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115. MODE OF CLEANING RICE; Wilson Ager, Rohrsburg, Pennsylvania.

Claim—The forcing of a current of air into or through the grain during the cleaning operation, for the purpose set forth.

116. CAR SEATS AND COUCHES; Horace L. Arnold, Elk Horn, Wisconsin.

Claim—1st, Jointing the ends of the seats next the sides of the car to a stud or bolt, so as to enable them to be arranged to right angles to the sides of the car, or to be swung round or turned to a diagonal position, and to thus occupy the spaces between them longitudinally and increase the width of the passage way, and thus admit of their elongation to convert them into distinct sleeping berths or couches. 2d, The combination of the slotted bar, eccentric lever, clamp, and plates, with lips or raised edges for firmly fastening the seats in the required position to answer their designs. 3d, The combination of the slides, or their equivalents, and the T-shaped bars for sustaining the backs of the seats in an inverted position, and bolts or slides for securing the backs in their said inverted position.

117. SEEDING MACHINES; John Badger, Ballyville, Illinois.

Claim—The circular plates and stirrers attached to the rotating shaft within the seed box, arranged and combined with the slotted bottom and slide, substantially as set forth.

118. PEGGING JACKS; T. D. Bailey, Lowell, Massachusetts.

Claim—1st, The method of jacking the last by turning the plate to which the last is fastened. 2d, The

combination of the lever, screw, and turn-table, for jacking the last. 3d, Fastening the screw, or its equivalent, stationary, by means of the coupling pin and plate, so that when the turn-table is revolved, it shall operate the lever and jack the last. 4th, Fastening the screw, or its equivalent, to turn the plate, after the last has been jacked, by means of the coupling wheel and pin operated by the thumb latch and spring, for the purpose of preventing the screw from turning round and loosening the lever. 5th, The combination of two hinges, cam levers, hinge seat, the link, and hand set-screw, for the purpose described.

119. HARVESTERS; J. A. Barrington, Fredericktown, Ohio.

Claim—The combination of the bell crank and guide piece with the crane and rod, connecting the crank arm with the rakes and the crank shaft, giving motion to the system. Also, connecting the entire raking mechanism with the vibrating frame, substantially as set forth.

120. STOVES; B. W. Belson, Philadelphia, Pennsylvania.

Claim—The combination of the air chamber surrounding the base of the fire-pot with the annular chamber at the upper part of the fire-pot. Also, the jet-pipe, in combination with the annular chamber and escape pipe. Also, the adjustable heater, constructed as described.

121. COMPOSITION FOR ROOFING; C. A. Bremner, Goshen, New York.

Claim—The composition consisting of marl and the other substances specified, combined and compounded in about the proportions and in the manner substantially as set forth.

[This is a compound of coal tar, rosin oil, india rubber, shellac, and linseed oil, with alum, litharge, borax, ochre, and dry marl, which, when mixed in the proportion specified in the patent, make an excellent and durable roofing cement.]

122. PEPPER CRUET; H. T. Clawson, Newbern, North Carolina.

Claim—Placing within the perforated top or cap of a pepper cruet or box, a rotating or reciprocating partially rotating brush, arranged substantially as set forth.

123. CUT-OFF GEAR FOR STEAM ENGINES; John Broughton, City of New York.

Claim—1st, The combination of the two rock shafts, their arms, the vibrating links, the rods, and the lifters, the whole applied to operate upon a tappet or tappets on the valve stem, or its equivalent, for the purpose of lifting the valve, and subsequently tripping it by the continued and inherent motion of the lifters. 2d, In combination with the above specified lifting and tripping mechanism, the combination of the pendulons rods, the toggle links, and the slide, or their equivalents, connecting with a governor or other means of adjusting the same to vary the positions of the centres of motion, for the purpose of varying the point of cutting off the steam.

124. HARVESTERS; Chester Bullock, Jamestown, New York.

Claim—Attaching the vibrating cutter to the vibrating bar and fingers, as described.

125. PROPELLER FOR LIFE-BOATS; Mortimer M. Camp, New Haven, Connecticut.

Claim—The method of propelling inclosed life-boats by the application of the power of the occupants of the boat, as set forth.

126. ELLIPSOGRAPH; E. G. Chormann, Philadelphia, Pennsylvania.

Claim—1st, Constructing the shoes in two parts, swiveled together as specified, in combination with the adjusting screw shaft. 2d, In combination with the screw adjustment of the movable shoe, the arrangement of the pencil or dry point carrier on a screw shaft, in order that the relative lengths of the axes may be readily varied to the smallest extent or a series of concentric ellipses be drawn varying very slightly in size. 3d, Arranging the drawing apparatus with a vibrating adjustable arm on a vertically adjustable arm, as described.

127. BREECH-LOADING REVOLVING FIRE ARM; E. Claude, City of New York.

Claim—Making the arm, between the barrel and exterior shaft, the bearing for the cylinder by a shaft on the forward end of the cylinder passing through and secured to the arm, when the said parts are combined with breech-piece and stock, so that the cylinder is rotated and stopped and the discharge effected, substantially as set forth.

128. SHINGLES; H. T. Clay, Gardiner, Maine.

Claim—1st, A shingle of uniform thickness at the butt so far as it is to be laid to the weather. 2d, A shingle that commences to taper at the point on the upper side, where the next layer above covers it, and tapers all on that side.

129. PRESERVE CANS; P. H. Cotton, Demopolis, Alabama.

Claim—In combination with the channel outside of the neck of the can, the employment of a recess in the neck and the extension of the rim of the cap over such recess.

130. BUCKLES; John Cumberland, Mobile, Alabama, and J. R. McClintock, City of New York.

Claim—The buckle or clasp composed of the parts, A and B, or their equivalents, substantially as described.

131. BAGASSE FURNACES; Felix Daunoy, Carrollton, Louisiana.

Claim—The construction of bagasse furnaces, having the exit flue located in the interior of the furnace with the openings to admit the gas from combustion, when in combination with the wood or coal chamber, having a skeleton crown, and the grates on which the bagasse is consumed.

132. SLIDE AND FASTENING FOR SKIRT HOOPS; Alexander Douglas and S. S. Sherwood, City of New York.

Claim—The combined clamp and slide made entire of one piece by forming the clamp of the divisions and the slide of the lips, as described, the divisions being entire and connected at both ends to the plate, as shown, thus forming a continuous connexion around the end of the hoop.

133. CARPET FASTENER; Richard DeCharms, Philadelphia, Pennsylvania.

Claim—An eyeleted carpet or floor cover binding, for the purposes set forth.

134. HYDRANTS; S. P. Francisco and Wm. P. Dickinson, Reading, Pennsylvania.

Claim—Providing said cylinder and piston with suitable openings for the admission of the air, and for the purposes set forth.

135. BALANCING MILL-STONES; John Fairclough, Louisville, Kentucky.

Claim—The arrangement of the cylinders within the boxes, the former being provided with tubes having

screw threads on their outer and inner surfaces, and provided with screws, and the cylinders provided with projections which fit in the grooves of the boxes, as set forth. Also, the plates and bottoms of the cylinders, when screwed on the tubes and used in connexion with the nuts.

136. EXTENSION FINGER RING; Samuel Friend and George Seiler, City of New York.

Claim—The combination of the spring ring and folding bars, substantially as specified.

137. MACHINE FOR SEPARATING GARLIC FROM GRAIN; Philip C. Fritz, Barrytown, New York.

Claim—Separating garlic from grain by passing the same between crushing rollers, in the manner substantially as described that the garlic seed and kernels of grain will be crushed separately between the rollers, and the crushed grain allowed to descend into a proper receptacle, while the garlic seed, on account of the moisture or juice they contain, adhere to the rollers, and are scraped therefrom.

138. HORSE POWER FOR DRIVING RECIPROCATING SAWS; Edward M. Fuller, Salisbury, New York.

Claim—The connexion of the saw to the main body of a horse power which is operated by the circular movement of the animal, and extending the reciprocating rod, or its equivalent, from the main body of the machine across the track of the horse to the saw in such a position as to allow the horse to pass over it.

139. CUT-OFF GEAR FOR STEAM ENGINES; P. W. Gates, D. R. Fraser, and Thomas Chalmers, Chicago, Illinois.

Claim—The two sliding toe pieces, constructed as described, and applied within the rocking frame, to operate in combination with the double lifters attached to the valve stem, and with a stud and roller, or their equivalent, connected with a governor, or otherwise made movable.

140. MEDICATED FABRICS; Henry Glynn, Baltimore, Maryland.

Claim—Cloth or paper chemically prepared, for sanitary purposes, with a solution of which copper, or copper and calomine, are the bases, such manufactured article being designed for the prevention, or as a protection against, infectious or contagious diseases, and made as stated.

141. PAPER FILES; Edward R. Godfrey, City of New York.

Claim—The method of securing and transferring hooks to the back or steadying weight, by folding and uniting their ends down the entire length of the channel or groove in the lower surface of the back, so as to prevent them from twisting and dropping the file of papers, as would be the case if the ends of the wires were simply riveted into the back.

142. SEATS AND SLEEPING COUCHES FOR RAILROAD CARS; Plymon B. Green, Chicago, Illinois.

Claim—1st, The arrangement under the seat, of a sliding drawer which has one portion of its top cushioned, and the other portion open, in combination with the hinged back, or cushion and stationary cushions. 2d. In combination with the above, the arrangement of the upper couches on hinges in the peculiar manner specified, so that they can be adjusted with facility.

143. HANGING WINDOW SASH; Theodore F. Hull, Marietta, Ohio.

Claim—The employment and arrangement of pulleys or friction rollers at the lower corners of the sash, and the balancing of the sash on cords, in combination with pulleys and weights, or a weight, substantially as set forth.

144. MANUFACTURE OF PORTABLE FANS; John C. Hall, Fayette, Mississippi.

Claim—The fan, when constructed in the manner described.

[This invention consists in having a series of short bars or rods jointed together, so that they may be folded into a compact cylindrical form, and distended to an annular shape. The bars or jointed rods form the frame of the fan, and a piece of silk, or other suitable material, can be attached to them to form a cover or body, which, when the frame is distended, is stretched sufficiently tight to form an efficient fan. The fan, when the frame is closed or folded, occupies very little space.]

145. RAILROAD RAILS; Augustus Plinta, Albany, New York.

Claim—The construction of a railway rail by forming the same of a hollow of an elliptical or oviform shape in cross section, the lower portion of the arch being extended into a foot or flanch, and a segment of the upper arch being extended into a lip or face for the tread of car wheels, slots being made through the bottom and across the lower part of the body of the rail, substantially in manner and form set forth.

146. MANUFACTURE OF SCISSORS; Henry Havell, Newark, New Jersey.

Claim—The forming of the blades of scissors or shears by means of the use of the intermediate plate, or by soldering or brazing the malleable cast iron and steel together. Also, in the manufacturing of scissors or shears, the use of the die, as before mentioned, and the striking together and into the required line and shape, the component parts of the blades, substantially in the manner described.

147. METHOD OF GATHERING GRAIN UPON, AND DISCHARGING IT FROM, THE PLATFORM OF HARVESTERS; Obed Hussey, Baltimore, Maryland.

Claim—The method described of gathering grain upon and raking it from the platform of a reaping machine, and depositing it upon the ground, by a raker riding on the machine directly behind the horses, and the gearing facing obliquely towards the grain which the machine is advancing to cut, and who, at a single operation with his rake, first, presses the grain in front of the machine backward against the cutter and over upon the platform; secondly, by a pivotal motion turns the prostrate grain upon the platform with its stalks parallel to the cutter; thirdly, slides the grain endwise off the platform at the side of the machine; and, fourthly, deposits the grain in a gavel on the ground behind his seat and across the track of the driving wheel of the machine.

148. HOOP LOCK; Edwin A. Jeffery, Corning, New York.

Claim—A hoop lock composed of a shell or socket and a taper pin, made as described.

149. BOTTLE-STOPPERS; Thomas Lewis, Malden, Massachusetts.

Claim—A ball valve-stopper, as made with the separate cap provided with a discharging tubular mouth and crossed bars, or equivalents, for detaining the ball, as described, and connected with the main tube or body by a screw, or its equivalent.

150. FOLDING BENCH; Tristram S. Lewis, Kendall's Mills, Maine.

Claim—The arrangement and combination of the hinge blocks, the leg slides, and the confining slide, as applied to the parts, A B, and their legs connected or hinged together so as to fold up.

151. MACHINES FOR ELEVATING HAY, &c.; James C. McGrew, Smithfield, Ohio.

Claim—The arrangement of the bar and inclined platform, with the shears and hoisting fork, substantially as described.

152. BUOYANT PROPELLER; James Montgomery, City of New York.

Claim—1st, The described or substantially equivalent means of securing the flotation of a screw propeller by ejecting water therefrom by centrifugal action. 2d, The detachable hollow blades in the described combination with the shaft, for the purposes set forth. 3d, The application of the valve, arranged as described, in the forward end of the hollow shaft, for the purpose explained.

153. SEEDING MACHINES; Albert W. Morse, Eaton, New York.

Claim—The arrangement of the hopper with the rollers, g g, belt or strap, r, rollers, m, and rings, as described.

154. DRAFTING SHIRTS; John Peckham, New Haven, Connecticut.

Claim—Drafting shirts by means of the neck and breast measures, formed and applied to the cloth, as shown and described, so that the neck circle will be chiefly cut or formed in the back portion of the shirt, and the upper part of the back portion folded over and united to the top of the front portion on a line with the base of the neck, as set forth.

155. QUOINS FOR GUN CARRIAGES; David D. Porter, U S. Navy.

Claim—The combination and arrangement of the degree rack or racks, the axle thereof, the T-bolt and its groove, with the bed and wedge. I do not claim the mere use of raised projections for indicating numbers by the touch of the fingers, as I am aware that such is not new. But I claim the combination and arrangement of the tangible scale and axle with the degree rack and the wedge, so that by the application of the finger to both scale and axle at one and the same time, and during the night, or otherwise, the proper position of the wedge may be determined for any desirable elevation of the gun.

156. SELF-ADJUSTABLE LEVELING INSTRUMENT; Joseph Redhead, Woodville, Mississippi.

Claim—Combining with the dish or case an inclined rod and ball or weights, so that when said case is set upon an inclined staff by its steel point, the ball will swing in the case into a level position, for the purpose of making a leveling instrument for ascertaining the ascent or descent of ground, as set forth.

157. MACHINE FOR BORING WOOD; George F. Rice, Worcester, Massachusetts.

Claim—The hollow cross-bar, together with the double head bolt, which enables the operator to fasten the uprights at any angle by simply turning one nut.

158. GOVERNOR FOR STEAM ENGINES; H. C. Sergeant, Columbus, Ohio.

Claim—1st. A steam engine governor composed in part of a steam engine which is subject to a uniform resistance, and which works independently of, and by its own velocity controls the velocity of, the engine to be governed, substantially as set forth. 2d, The employment of two disks having spiral projections on their faces, and provided with stop pins, applied to combine an engine which is to be regulated, with an isochronous revolving regulator. 3d, The combination of what is herein termed the "regulator engine," its regulator and regulating valve, or their equivalents, and the shafts, H and M, and their spiral-faced disks, one driven by said engine, and the other by the engine to be governed, the whole applied and operating in combination with a regulating valve, or its equivalent, substantially as described.

159. BRUSH; Reuben Shaler, Madison, Connecticut.

Claim—A brush, the bristles of which are secured by winding them into a spiral groove, and fastening them in the manner described, or by winding them into cement, as set forth.

160. BOILER FURNACES; Evan Skelly, Plaquemine, Louisiana.

Claim—The combination and arrangement of the gradually contracted fire chamber with the bridges, as described.

161. HARNESS BUCKLES; Orin B. Smith, Monticello, New York.

Claim—The combination of the lever, operating as described, with the bow, for the purpose of making a harness or other buckle, and to which may be attached straps, as set forth.

162. HOMINY MILLS; Ira Speight, Woodville, Mississippi.

Claim—Hanging mill-stones by means of right and left screws, substantially as set forth.

163. BUCKLES FOR SKIRT HOOPS; John Stevens and James Handley, City of New York.

Claim—The buckle, when constructed substantially in the manner described, in combination with the slides, having holes to receive the hook of the buckle.

164. MITRE BOX; Asa F. Tarr, Rockport, Massachusetts.

Claim—A mitre box having a sliding frame attached to pivoted standards, and otherwise made, as described.

165. CAM PRESS; Enoch Thomas, Beverly, Virginia.

Claim—The mode of making and arranging the journal boxes so as easily to vary the space under the follower, and retain the uniform position of the pressure, in combination with the cam and windlass, cast solid, when constructed and operated substantially as specified.

166. DYNAMOMETER; Wm. Tucker, Blackstone, Massachusetts.

Claim—The combination of the grooved slider and its screw connexion with the index pointer, or its equivalent, and the spring and pulley, or its equivalent, applied to a shaft, substantially as described, the slider having a feather connexion with the said shaft, as explained.

167. PLOUGHS; Reed Vincent, Rockton, Illinois.

Claim—The combination of the convex standard, the braces, and the mould-board, when arranged in connexion with the beam and bent handles, as described.

168. LABELS FOR TREES, &c.; Francis T. Cordis and Wm. W. Wade, Long Meadow, Massachusetts.

Claim—The combination of a metallic ring or back with paper, or other suitable substance, on which is written or printed the name of a tree, shrub, plant, or seed, and a plate or plates of mica and a metallic ring, in either of the modes described, as a tag or label for designating and distinguishing the varieties of trees, shrubs, plants, and seeds in orchards, nurseries, and gardens.

169. APPARATUS FOR PURIFYING GAS; Andrew Walker, Claremont, New Hampshire.

Claim—The combination and arrangement of separate chambers, opening into each other in such man-

ner that a current of water or fluid may be made to flow through the series in thin falls or sheets, or from one chamber to the next in a thin fall or sheet, and a current of gas be made to pass upward and through the several chambers, and successively through and against the several falls or sheets of fluid, the chambers being disposed one over the other in column, and the whole being to effect the purification of gas for illumination, as described.

170. STOVES; David Wells, Lowell, Massachusetts.

Claim—The arrangement of the flues, smoke chamber, air-heating chamber, and fire chamber, the latter communicating with the smoke chamber by means of the perforations, and the smoke chamber communicating with the air-heating chamber by perforations, substantially as set forth.

171. MANUFACTURE OF GLASS FURNACES AND POTS; Ezra Wells, Covington, Pennsylvania.

Claim—Pots and furnaces made of the black American clay, for use in manufacturing glass and glassware, substantially as set forth.

172. METHOD OF ATTACHING CUTTING LIPS TO AUGER SHANKS; Norman S. White and Aaron Denio, Shaftsbury, Vermont.

We do not claim, broadly, attaching the cutting parts to the screw shaft of augers. But we
Claim—The specific manner set forth and shown in the specification.

173. SMUT MACHINES; J. A. Woodward, Burlington, Iowa.

Claim—The arrangement of the wire cloth cylinder, scourer, deflecting or separating bar, spout, and shoe, as set forth.

174. INSTRUMENT FOR MEASURING ALTITUDES, &c.; George C. Ayling, Assignor to self and Henry A. Ayling, Boston, Massachusetts.

Claim—The arrangement of the index glass with respect to the detector glass, so as to enable the latter to be moved either into parallelism with, or at right angles to, the former, and combining with the detector glass and the main divided arc and index, a secondary index and divided arc, applied to register the movements of the detector glass, substantially as described.

175. WATCH FACES; Samuel Baldwin, Assignor to Baldwin & Co., Newark, New Jersey.

Claim—Arranging the figures of the dial without turning the works of the watch in a plane parallel to its face, so that they may be in the proper positions in relation to the pendant, whether the dial faces be the open or closed bizzle of the case.

176. CLOTHES FRAME; Wm. Hathaway, Assignor to Wm. G. Maynard, Worcester, Massachusetts.

Claim—Arranging the centre of motion of the cross-bars, so that the centre of motion of the outer end of the cross-bar, when the frame is closed, will be over or within the centre of motion of the inner end of the cross-bar.

177. HEMP BRAKES; Robert Heneage, Assignor to self and Edward O. Ball, Buffalo, New York.

Claim—1st, The combination of the reversing mechanism with the brake, beater, and shell, for the purpose of dressing hemp, as set forth. 2d, The combination and arrangement of the brake with the revolving beater, shell, and revolving apron, for the purpose of dressing flax. 3d, The arrangement of the chamber within the machine, for the purpose of affording room for the movements of the hemp while being dressed, substantially as described.

178. MACHINE FOR TURNING TAPERING TWISTS ON WOOD; Reuben K. Huntoon, Assignor to self and Jacob B. Rand, Concord, New Hampshire.

Claim—The arrangement of the several separate devices described, when operated as set forth, for turning irregular tapering forms of wood.

179. MANUFACTURE OF PAPER PULP FROM WOOD; Charles Marzoni, Assignor to J. Gandolfo, City of N. York.

Claim—1st, The use and application of the peculiar stone called "adamantine," described, when used as a means of tearing the woody fibre into a state suitable for pulp for paper, by rotation, or any other substantially similar manner. 2d, I do not claim steaming the wood, nor the use merely of hot water—but I claim the combining the use of the hot water at the boiling point, or 210° Fah., with the stone in rotation while acting upon the wood simultaneously and continuously, so that the hot water and flakes or particles of woody fibre immediately become united into pulp. 3d, The apparatus consisting of the cover or box, the boxed openings therein, and arms, rods, and weights, by which the blocks of wood are fed and held to the surface of the stone.

180. FAUCETS; Martin Robbins and James Powell, Assignors to James Powell, Cincinnati, Ohio.

Claim—The application to the key stem of the collar, cushion, and loose collar, or their equivalents, arranged in combination in the manner described, to compensate for the lateral wear or displacement of the stem.

181. ICE PICK; John L. Rowe, Assignor to Frederick Stevens, City of New York.

Claim—The spiral spring, in combination with the handle, rod, and point, arranged substantially as specified.

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182. BOOT JACK; Frederick Ahl, West Meriden, Connecticut.

Claim—The arrangement of the platform, vibrating arm, and cross-bar, as described.

183. LETTER ENVELOPE; James G. Arnold, Worcester, Massachusetts.

Claim—Making letter envelopes by cutting, folding, and pasting the paper, substantially in the manner described. Also, folding narrow folds at the ends or sides, so as to come inside between the face and back, in the manner described.

184. MANUFACTURE OF PYROGENIC OILS; Luther Atwood, Brooklyn, New York.

Claim—Forming oleaginous vapors from substances yielding pyrogenic oils, by the action of the heat of a properly regulated current of products of combustion passing over and above the surface of the mass, operated on with or without the aid of external heat, substantially as described.

185. APPARATUS FOR DESTRUCTIVE DISTILLATION; Luther Atwood, Brooklyn, New York.

Claim—The combination and arrangement of a "distilling tower" and receiving vessel with a steam blast,

or its equivalent, in the combination, for the purpose of producing an induced current, substantially in the manner described.

186. APPARATUS FOR DESTRUCTIVE DISTILLATION OF WOOD, &c ; Luther Atwood, Brooklyn, New York.

Claim—1st. The use of the inner case in the manner set forth. 2d. The described arrangement of the flues leading from the annular passage into the distill ng tower. 3d. The combination with the distilling tower of the combustion chamber or fire-place, when so arranged as to supply products of combustion by a downward draft through the fire-place, substantially as described.

187. LAMPS; William W. Batchelder, City of New York.

Claim—The small tapers or wick tubes, D, placed on both sides of the flat burner or wick tube, C, in combination with the cap, when the said tubes and cap are used without a chimney, substantially as set forth.

188. MANUFACTURE OF ARTIFICIAL FUEL; Wm. A. Bradley and Jacob Bigelow, Washington City, D. C.

Claim—The manufacture of artificial fuel made from refuse bituminous coal, anthracite or charcoal, combined with the substances herein described.

189. GRAIN MEASURE; Job Brown, Lawn Ridge, Illinois.

Claim—A grain tally having a slide operated by a pendent and spring, a lever, pawl, ratchet wheel, and indicating belt, the whole combined as described.

190. REVOLVING FIRE ARMS; John W. Cochran, City of New York.

Claim—1st, The hinged or jointed thumb-piece of the hammer or cock, constructed as set forth. 2d, The worm-wheels upon the cylinder shaft, and the tumbler shaft or hammer shaft, combined as described. 3d, The means, substantially as set forth, for allowing the cylinder to be rotated within its frame independent of the shaft of the hammer or tumbler, and also allowing of the detaching of the cylinder and its shaft from the frame and from the means of rotation.

191. COMPENSATING PENDULUM FOR CLOCKS; Wright S. Coffinberry, Grand Rapids, Michigan.

Claim—The combination of two metals of different expansibility, in the manner and for the purpose set forth.

192. STUMP EXTRACTORS; Francis M. Eagle, North Manchester, Indiana.

Claim—Overcoming the resistance by the movement of a roller invariably connected with the stump upon a track either rectilinear or curved, all parts of which, except the starting point of the roller, are exterior to the circle, with the invariable connexion for a radius, and the point of attachment of the hook for a centre, the operation being substantially as described.

193. STOVES; Nelson Edwards, Chittenden Co., Vermont.

Claim—The application to a stove of an improved combined hydro-atmospheric jet and gas chamber. Also, the stove-contained coiled smoke-pipe, in its combination with the plurality of stove walls, substantially as described.

194. SPRING BOTTOM FOR CHAIRS AND OTHER SEATS; Patrick Gallagher, Pleasant Unity, Pennsylvania.

Claim—Making the bottoms of chairs, or other seats, of spring plate metal, so that, when laid loosely upon the frame, said plates shall be both a bottom and a spring, substantially as set forth.

195. PRINTING PRESS; S. R. Cotton, Green Bay, Wisconsin.

Claim—Operating the form bed from the pressure cylinder, A, by means of the cam or eccentric, M, provided with the pin, O, rack bar, D, provided with the projection, P, and roller, N, the pinions, E G, on the shaft, F, with or without the pinion, H, slide bar, I, and spring, S, and the rack bar, I, as set forth. Also, the toothed sector which gears into the pinion of roller, a', and is connected with the rack bar, D, by means of the slotted arm on the rack bar, and the arm of the sector provided with the pin, o, the rod, c', attached to the arm, d', the pawl, l', attached to the arm, d, and the ratchet, h', attached to the roller, g', the whole being arranged so that the inking device will be operated automatically from the pressure roller. Further, having the bearings, b b, of the pressure cylinder, attached to rods, d d, which are connected by tension nuts to straps that encompass the eccentrics, g, of the shaft, h, for the purpose of readily raising, when necessary, the cylinder, B, and regulating its pressure.

196. STEERING PROPELLER; H. E. Teseel, Chicago, Illinois.

Claim—The arrangement and combination of the slotted frame, propeller, driving shaft, and chair wheel, substantially as described.

197. SEEDING MACHINES; Joseph Fowler and F. M. Bacon, Ripon, Wisconsin.

Claim—The reciprocating perforated slide, stationary perforated slide, and perforated roller, in connexion with the inclined board, arranged to operate as set forth.

198. SHUTTLE BOXES FOR LOOMS; A. F. Gibboney, Union Township, Mifflin Co., Pennsylvania.

Claim—The half swell on the inner end of the fly to be operated on by the picker, as set forth.

199. SASH FASTENER; Porter A. Gladwin, Pawtucket, Massachusetts.

Claim—The employment of the perforated plate with the notch spring, as described.

200. PROPELLER FOR BOATS; James Hamilton, City of New York.

Claim—The arrangement of two sets of propeller buckets in a reciprocating frame, so that they act in opposite directions to give head or stern way respectively, when said buckets are combined with sliding stops, fitted and acting to retain one set of buckets in a folded and inoperative position, while the other set is acting to move the vessel, as set forth.

201. TYPOGRAPHER; Henry Harger, Delhi, Iowa.

Claim—1st, The employment or use of the bed-piece, frames, D and C, and type frame formed of the plates, E E, arranged substantially as set forth. 2d, The particular means employed for feeding the frame, C and paper or wax to the type, to wit: the bent lever connected to the hand lever, the ratchet, and cords or chains attached to the frame, C. 3d, Regulating the feed movement of the frame, C, by having the types made of varying heights or lengths, so as to give corresponding lengths of vibration to the lever, substantially as described.

202. FURNACES FOR BURNING LIME; Thomas R. Hartell, Philadelphia, Pennsylvania.

Claim—As an improvement in reverberatory furnaces for burning lime, providing a recess in the side walls in which a corresponding projecting edge of the fire-proof traveling platform fits, in the manner de-

scribed, for the purpose of cutting off all communication between the heated upper chamber and the cool lower chamber, at the same time presenting no obstruction to the forward movement of the truck and platform.

203. Lock; Spencer Hiatt, Indianapolis, Indiana.

Claim—1st, The combination and arrangement of the tumblers and key bits with the lever, sliding yoke, and lever arms, when constructed as set forth. 2d, The combination of the comb spring and slide with the tumblers, when constructed as set forth.

204. Breech-loading Cannon; John W. Hollensbury, Alexandria, Virginia.

Claim—1st, A breech-loading cannon formed in two parts and secured together by means of a frame. 2d, In combination with the two divisions of the cannon the frame fitting closely up against the breech and capable of being elevated or depressed, as set forth. 3d, In combination with the two divisions of the gun, the hand or circular wedge, constructed as described.

205. Ladies' Hooped Skirts; John Holmes, Boston, Massachusetts.

Claim—The net-work fabric described, having the number or size of its meshes reduced toward the top in such a manner as to throw the fullness in one direction or on one side, so that when the hoops are inserted it is self-sustaining, to produce the "bishop" or "bustle" form, and preserve that form to the bottom of the skirt, as set forth, without the use of lacings, springs, extra "busties," or other contrivances.

206. Method of Adjusting the Tripper to the Escapement Lever of Time-keepers; Edwin B. Horn, Boston, Massachusetts.

Claim—The movable plate, or its equivalent, supported so as to be capable of turning on a pivot, or its equivalent, carried by the stand, the same being for the adjustment of the beat or the pin or tripper of the escapement lever, as specified.

207. Inkstand; Thomas S. Hudson, East Cambridge, Massachusetts.

Claim—The arrangement of a vent hole within the flexible or elastic diaphragm, and with respect to the ink receiver, essentially in manner as described.

208. Tool for Slotting Clothes Pins; John Humphrey, Keene, New Hampshire.

Claim—Arranging knives or cutters to widen or flare the outer ends of the slots in clothes pins simultaneously with the sawing thereof, by having portions of the plate of the saw removed, and the cutters secured to the sides or flanches on the arbor, and held thereby independent of the saw, by which arrangement a perfect and complete slot may be cut at a single operation, and the cutters may be quickly and accurately adjusted to any required position, and be securely kept therein or be readily removed when desired.

209. Propelling and Steering Apparatus; Samuel Huse and Samuel Huse, Jr., Chicago, Illinois.

Claim—As an improvement in propellers when hung within the rudder and operated by gears, receiving the end thrust of the propeller shaft upon the sleeve on the post, arranged as described.

210. Spring Tackle Block; Obed Hussey, Baltimore, Maryland.

I do not confine myself to any special form or arrangement of the strap and the block, or of either (as these may be indefinitely varied), so long as the block is constructed with a seat to yield to the force of sudden shocks, and thereby prevent the dangerous jerks, which, as described, it is the object of my invention to prevent. But I

Claim—A block having a yielding seat, substantially as set forth.

211. Preserving Fruits; John R. Jenkins, Kingston, Pennsylvania.

Claim—Dusting the articles to be coated with any dry powder, such as plaster of Paris, or its equivalent, to prevent the coating from adhering to the articles coated, and permitting it to come off readily.

212. Gas Retorts; Wm. H. Laubach, Philadelphia, Pennsylvania.

I do not desire to confine myself to the particular form of the retort illustrated, or to the exact shape of the plate, D, inasmuch as both may be considerably modified in shape without any deterioration of the result.

Claim—Dividing the retort into an upper and a lower chamber by means of a movable plate, D, said plate being so constructed and so arranged in respect to flanches or projections in the retort, and being so weighted that the amount of vapor admitted into the communication between the two chambers shall be proportionate to the rapidity with which it is generated, and that the vapor shall pass from the lower chamber in a stream so attenuated and so exposed to red-hot surfaces, as to insure its being converted into permanent gas on entering the upper chamber, as set forth.

213. Clothes Horse; Tristram S. Lewis, Kendalls' Mills, Maine.

The arrangement of the four spring catches is such that the spring, while operating to press the horse open, and to maintain it in an extended state when unfolded, will also operate to maintain all the catches in engagement with their respective slats. Therefore, when the posts are hinged together, and the four folding sets of slats are applied to them, and arranged on them as described, I

Claim—The arrangement of the spring and the two sets of spring catches, in order that the said spring may perform at one and the same time the two functions, as specified.

214. Fruit Cans; W. W. Lyman, West Meriden, Connecticut.

Claim—In combination with the groove for receiving and holding the packing and the flanch on the cover, fitting into said groove and against the packing, the sleeve with its cam slots, and the studs on the neck of the can, for drawing the flanch of the cover tight down on to the packing without crimping it.

215. Cultivators; Howard Mann, East Attleborough, Massachusetts.

Claim—1st, The application of each wheel arbor to its wheel and the frame, so that the wheel may turn on the arbor and the latter extend into slots, and have fastenings, whereby not only the wheel may be adjustable with reference to the cutters, but the arbor and its screws and nuts may be employed to strengthen the frame. 2d, The described arrangement of each of the slots of the wheel arbor, with respect to the scraper of the periphery of the wheel, whereby the wheel at whatever altitude it may be placed while its arbor is in the slots, will be at one uniform or proper scraping distance from the scraper. 3d, The application or arrangement of the slide bar of the cutter, so as to operate not only as a scraper to the wheel, but as a supporter of the cutter post or rod.

216. Seed Planters; F. M. Marshall, Seguin, Texas.

Claim—The arrangement of perforated plates, beam, gauge wheel, bull tongue plough, roller, crank, arm, and handles, the whole being constructed as set forth.

217. MACHINES FOR PICKING CORN; S. W. May, Gatesburg, Illinois.

Claim—The bars, the elevators, the fingered belt, the frame, the crank with its pitman, or their mechanical equivalents, the whole being combined as set forth.

218. LOCOMOTIVE AXLE BEARINGS; David Matthew, Philadelphia, Pennsylvania.

Claim—The peculiar construction of journal-box or bearing in one piece, having a longitudinal slot or opening, operating substantially as set forth.

219. DOOR SPRING; T. J. Mayall, Roxbury, Massachusetts.

Claim—The described india rubber torsion door spring.

220. SHIRT STUD; Charles McIntire, Newark, New Jersey.

Claim—The latch and catch, constructed substantially in the manner set forth.

221. CORSETS; Anne S. McLean, Williamsburg, New York.

Claim—Providing the upper sections or pads of the corset with cone-shaped flat steel, or their equivalent springs and spring supporting plate next the body, for the purpose of giving elasticity to the pads, which pads are held in their places by the weight of the corset.

222. IRON PAVEMENTS; Richard Montgomery, City of New York.

Claim—A metallic pavement, consisting of a series of parallel arched corrugations, reaching or extending from the curbstone on one side of the street to the curbstone on the other side. Also, casting or making the upper parts of the corrugations thicker than the lower parts, in the manner set forth. Also, supporting or anchoring the pavement when it is cast in sections by a grooved central support, as shown. Also, the dovetailed recesses and projections, in combination with the projections, for the purpose of holding the pavement in place.

223. DEVICE FOR TRANSMITTING ROTARY MOTION; Henry Morris, West Philadelphia, Pennsylvania.

Claim—The combination of the convolute gear and convolute groove with a sliding pinion or gear, substantially as described.

[This invention consists in the combination of two beveled gears, one of which has its teeth arranged in convolute form, and the other of which, gearing with the first one, has its teeth concentric to its axis; the latter being fitted to slide on its shaft that it may, when geared with and driving or being driven by the first one, approach or recede from the axis of the same under the guidance of a convolute groove, which is formed between the convolute coils of teeth, and be thereby caused to receive from or impart to the first one a gradually increasing or diminishing velocity. The device may be applied to many purposes in machinery, but is more particularly intended to be applied to the spinning mule, the first gear being secured to what is known as the "scroll shaft" of the mule to drive the other one, which is attached to a shaft which drives the rollers, for the purpose of producing a gradual diminution of speed of the rollers before stopping them after the mule carrier has moved out a certain distance from the rollers, and thereby prevent the jerk on the yarn, which is caused by stopping the rollers suddenly.]

224. BLIND FASTENER; John Murphy, Boston, Massachusetts.

Claim—The arrangement of the spring catch on the pintle step shank, and with respect to the notched pintle. Also, combining with the catch and its case a movable projection or cover, applied so as to be capable of being moved on and off the pintle head, and to carry the thumb projection or stud of the catch, substantially in manner specified.

225. LATHE FOR TURNING MASTS, &c.; P. H. Niles, Boston, Massachusetts.

Claim—1st, The revolving traversing cutters, in combination with the dogs, or their equivalents, for supporting the stick of timber, operating in the manner described. 2d, Raising the dogs automatically as the cutters approach them. 3d, The method of controlling the position of the cutters by means of the combination of the slotted wheels, the gears, and the pattern, and their connexions, substantially as set forth.

226. CONSTRUCTION OF IRON RAILING; James Nuttall, New Orleans, Louisiana.

Claim—The combination of bent sheet metal rails, with grooves in the panels, receiving the edges of the rail, and giving an internal and external bearing to the rail, substantially as set forth.

227. LATHE MACHINE; Jacob Pefley, Bainbridge, Indiana.

Claim—The combination of the reciprocating knife, the bolt supports or bars, and the stationary bar or bed, arranged substantially as set forth. Also, the shaft provided with the bent rods, and connected or arranged with the rock shaft of the bars through the medium of the levers, bars, and the arm, substantially as set forth. Also, in connexion with the knife, bars, and bed, the registering device operated from the rock shaft through the medium of the pawl connected with the lever, rod, and bent lever, so as to be thrown in contact with the ratchet by the bolt, as set forth.

228. CORES FOR MOULDING PLASTIC SUBSTANCES; James Pilgrim, New Britain, Connecticut.

Claim—Constructing cores for moulding in plastic clay, cement, or other like substances, of india rubber, or equivalent material, so that they be inflated and collapsed, substantially as described.

229. PESTLES FOR CLEANING CLOTHES; Ezra Pollard, Albany, New York, Assignor to self and B. W. Seeley, City of New York.

Claim—A clothes pounder or pestle composed of a stock, handle, tubes, and openings, as described.

230. BURNISHING ATTACHMENT FOR LATHES; James S. Ray, East Haddam, Connecticut.

Claim—The arrangement and combination of the plate, E, plate, F, spring, mandrel, and tool, as described.

231. STEERING APPARATUS; Jesse Reed, Marshfield, Massachusetts.

Claim—1st, The duplex screw shaft, in combination with the nuts and guide rods, the rods being each permanently connected with one of the nuts, and passed through the lug on the other nut, operating in the manner specified. 2d, In combination with the above, connecting the nut to the rudder head by means of the arm, bulb, and rod, operating substantially as described.

232. TRACE FASTENINGS; Neil J. Reynolds, Webster, New York.

Claim—1st, The formation of the eye which receives the tongue, for the purpose described. 2d, The tongue, in combination with the tube, spiral spring, and bolt, which fastens the tongue in the eye.

233. RAILROAD CAR BRAKES; J. W. Rice, Springfield, Massachusetts.

Claim—1st, The suspension bar, crotch bolt, and nut, when arranged and operating in the manner de-

scribed. 2d, The continuous rod and loose pulley, in combination with the suspension bar and crotchet bolt and nut, when arranged and operating substantially as set forth. 3d, The loose collars on the standard, when applied in the manner set forth.

234. BEDSTEAD FASTENING; Oliver Robinson, Rochester, New York.

Claim—The combination and arrangement of the hooked locking bolt with the circular wrench and eccentric, for holding the bolt by means of the lip in the proper position for entering the post and tightening the connexion made with the pin, or its equivalent, substantially as set forth.

235. APPARATUS FOR WALKING ON THE WATER; Henry R. Rowlands, Boston, Massachusetts.

Claim—The construction and use of the apparatus by the arrangement of the metal floats, the metal ballast boards, and the wooden stanchions, in a manner substantially as described.

236. DREDGING MACHINE; James Stewart, New London, Connecticut.

Claim—The arrangement of three series of dredging buckets in the same dredging machine, for the purpose of excavating a channel in the earth throughout the entire width of the boat. Also, arranging the windlass barrels which raise the dredging apparatus out of the water, on the same shaft that operated the dredging chains, so that they may be locked to the shaft to raise the dredging apparatus without stopping the chains of dredging buckets, substantially as described.

237. BURRING MACHINE; O. W. Stow, Southington, Connecticut.

Claim—The arrangement and combination of the spring, gauge, and rollers, substantially as described.

238. MANUFACTURE OF STARCH; S. T. Stratton, Philadelphia, Pennsylvania.

Claim—Steeping the material from which the starch is extracted, either whole or crushed, in an alkaline or caustic alkaline liquor of a suitable strength and artificially heated to a temperature of from 70° to 130° Fah., as specified.

239. WASHING MACHINE; G. W. Swigert, Monmouth, Illinois.

Claim—A cylinder of brushes, a concave supported on spring, guard, attached to rod, pounders, tappet drum, and otherwise constructed as described.

240. CLOSET FOR SEWING MACHINES; Wm. P. Uhlinger, Philadelphia, Pennsylvania.

I do not desire to confine myself to the described construction or combination of the various parts in every minutia. But I

Claim—Combining the sewing machine platform with the lid of the closet, that the opening and shutting of said lid shall operate the platform, substantially in the manner set forth.

241. RAILROAD CAR SEATS AND COUCHES; Nathan Thompson, Jr., Brooklyn, New York.

Claim—1st, The combination of longitudinal seats, with a raised platform and berths or reclining places beneath the seats and platform. 2d, In combination with berths or reclining places beneath a seat, and a raised platform serving as a foot-stool to such seat, I claim a back to that seat capable of being moved, or of change of place, so that it may serve, at will, as a back or as a couch above the main seat. 3d, Making the top of the platform or foot-place pertaining to the main tier of seats movable, substantially in the manner specified. 4th, Arranging within a railroad car, longitudinal couches along or upon the floor, and other couches or seats above these, with backs, which may be converted into couches and passage ways, or a passage way, from which free access may be had to all the seats and couches. 5th, Combining with longitudinal passage ways or a longitudinal passage way, longitudinal seats, when those seats have backs so constructed that they may be converted into couches, or when those seats are free to slide transversely, substantially in the manner described. 6th, Adjustable or movable end seats, substantially such as described, and serving, if necessary, as steps, in combination with longitudinal car seats, having backs capable of conversion into couches.

242. APPARATUS FOR GENERATING ILLUMINATING GAS; Charles A. Tyler, Washington City, D. C.

Claim—1st, The peculiar arrangement and combination of the retort for generating the hydrogen gas with the main retort for the generation of the illuminating gas. 2d, Elongating and contracting the rear end of the main retort, in the manner set forth. 3d, Connecting the rear end of the hydrogen retort with the contracted end of the main retort, in the manner set forth.

243. BURNERS FOR VAPOR LAMPS; Sigourney Wales, Boston, Massachusetts.

Claim—When the wick is supported on and around an inner wick tube and within an outer wick tube, and the jet-cap is made separate from and so as to screw or fit on the outer wick tube, as described, the application of a rod to the movable jet-cap and the inner wick tube, in such manner as to be fastened to the cap and extend into and fit the bore of the tube, so as not only to enable the jet-cap to be raised and supported above the wick in manner to allow such wick to be inflamed, and the flame thereof to heat the said jet-cap and rod, but to serve as a means of conducting heat from the jet-cap into the inner tube, by which such heat may be conducted into the wick in order to aid in vaporizing the liquid contents thereof.

244. MAKING EDGE TOOLS; Wm. White, Newark, New Jersey.

Claim—The use of wrought iron and steel separately or combined, while in a melted or liquid state, for the purpose of forming into shape axes and other articles, without the process of forging, welding, or swaging, by the use of a mould, the cavity of which is the shape or form of the articles desired, as set forth.

245. LIFE-PRESERVING TRUNK; Oliver Evans Woods, Philadelphia, Pennsylvania.

Claim—A valise or trunk, made substantially as shown and described.

246. THE CUTTING APPARATUS OF HARVESTERS; Wm. A. Wood, Hoosick Falls, New York.

Claim—The manner described of constructing the guards and uniting them to the finger-bar.

247. DOOR FASTENER; Gilbert Yates, West Dresden, New York.

Claim—A door fastener constructed of the pieces, A A′ A″, bolt, keeper, and slot, operating as set forth.

248. TURNBUCKLE FOR WINDOW BLINDS; Joseph L., Assignor to self and George Chapman, Philadelphia, Pa.

Claim—The turnbuckle and sliding collar provided with the flanch and the spring, placed on the spindle or arbor, as set forth. Also, in combination with the above named parts, the washer placed on the arbor.

249. RAILROAD CAR SEATS; George L. Dulaney, Assignor to self and Solomon R. Moore, Mount Jackson, Va.

Claim—The combination and arrangement of the movable seat bottoms, hinged folding cushions, sliding slat blind frames, and hinged cushioned frames, and cushioned flaps on the backs of the seats and slides or panels.

250. EXPANDING BIT; Harley Stone, Assignor to Paul P. Todd, Blackstone, Massachusetts.

Claim—The mode and application of the slide cutter, the slits, the bolt, and the graduated scale, constructed as described.

251. METHOD OF BLASTNG OR REMOVING SUBMARINE BODIES; Samuel Eakins, Assignor to self and M. S. Wickersham, Philadelphia, Pennsylvania.

Claim—The combination with a piece of ordnance to be employed under water for the removal of rocks or other bodies, by the operation described, of a series of adjustable legs, applied and operating substantially as and for the purpose specified.

[In this method of blasting or removing submarine bodies, a very heavy cannon, loaded with powder and ball, is sunk with its muzzle in contact with, or as close as possible to the face of the rock or other body to be removed, and fired by a galvanic battery, to project the ball against the rock. The weight of the column of water above the cannon, added to the weight of the cannon itself, prevents recoil, and causes the ball to be projected with immense force. The cannon has adjustable legs, which support it or attach it to the body to be removed, and enable it to be set at such angle as might be desirable to split off a ledge of rock. When the cannon has been fired, it is raised by chain tackles attached to it. Experiments show this to be a very effective method of blasting.]

252. STACKING AGRICULTURAL PRODUCTS; Carlos W. Glover, Farm Ridge, Assignor to self, Bronson Murray, and J. Van Doren, La Salle Co., Illinois.

Claim—Making a stack out of two, three, four, or more lengths of straw, or other material, that overlap or break joint with each other, and which are laid with their seed ends pointing to a common centre, and commencing at the apex and ending at the base, and drawn together and secured substantially as represented, using as a foundation to build upon an apron or the binding cords or chains, as set forth.

253. STACKING AGRICULTURAL PRODUCTS; John Van Doren, Farm Ridge, Assignor to self, Bronson Murray, and Carlos W. Glover, La Salle Co., Illinois.

Claim—The so placing of two, three, or more layers of stalks or straws in a box or former, that they shall break joint with each other, beginning at the apex and so continuing until one-half of the stack is formed, and then reversing the operation and laying them from the base to the apex for the other half of the stack, so that, when bound up, they shall form a stack shingled on its outside to protect the interior, substantially as described.

254. CAST IRON MERCURY BOTTLE; Moses Wrangle, Assignor to Hunter, Keller & Co., City of New York.

Claim—Moulding iron mercury bottles with concave bottoms by means of the patterns, substantially as described.

ADDITIONAL IMPROVEMENTS.

1. ROTARY PUMPS; Levi Burnell, Milwaukie, Wisconsin; patented August 31, 1858; additional dated December 14, 1858.

Claim—Operating three or more pairs of sliding valves in said pump, by means of the joint action of the rotary valves box, and the three-sided stationary cam, substantially as set forth.

2. MANUFACTURE OF SOAP; Dalrymple Crawford, Toronto, Canada; patented March 13, 1858; additional dated December 14, 1858.

Claim—Using the refuse of Indian corn, and mixing it with a fat or oil and an alkali, and with or without resin, amalgamating the same to make soap. Also, subjecting the refuse of Indian corn to an alkali, with or without heat, and modifying the strength of the alkali when too strong and not required by an acid, and for the purpose of mixing it more easily with the soap.

3. MACHINERY FOR DRESSING AND SIZING WARPS; Wm. Bradley, Manchester, Virginia; patented May 11, 1858; additional dated December 21, 1858.

Claim—The covering of the drying rollers with some non-conductor of heat, or material having less conductive properties than the material, to prevent the caking or uneven drying of the size in the warps.

4. CAR SEATS AND COUCHES; A. M. Holmes, Assignor to self and A. G. Purdy, Morrisville, New York; patented December 6, 1858; additional dated December 21, 1858.

Claim—The use of the adjustable back-pad, or equivalent, and combined therewith the adjustable head rests.

RE-ISSUES.

1. METALLIC TIPS FOR BOOTS AND SHOES; George A. Mitchell, Turner, Maine; patented January 5, 1858; re-issued December 7, 1858.

Claim—My described metallic tips, constructed in the manner set forth. Also, a metallic tipped boot or shoe, constructed essentially in the manner set forth.

2. PISTOLS AND OTHER FIRE ARMS; Ethan Allen, Worcester, Mass., formerly of Norwich Connecticut; patented April 16, 1845; re-issued December 14, 1858.

Claim—Extending the rear end of the dog or catch rearward and beyond where it is jointed to the tumbler of the percussion hammer, and connecting the upper end of the main spring directly to the part so extended, or otherwise connecting the main spring to the dog so as to cause it to operate upon the hammer, dog and trigger. Also, the arrangement of a mechanism in connexion with a self-cocking arrangement, whereby I am enabled to make the fire arm so as to be cocked at pleasure by the hammer, or to be operated entirely by the trigger, self-cocker, and mechanism consisting of the stud and the dog or catch, in connexion with the tumbler, or their equivalents, whereby the same results are obtained. Also, the piece of metal, as combined with or applied to the scre of the trigger, and in front of the notch thereof and hook of the catch, and operating in relation thereto, in the manner and for the purpose as explained. Also, my peculiar arrangement of the pitman upon the scre of the trigger, so as to operate, as above described, in combination with the construction and arrangement of the teeth upon the breech or rear end of the cylinder or series of barrels, by which improvement in constructing and arranging the aforesaid parts I am enabled to very much simplify them, in comparison with the manner in which they have been made and disposed.

3. CORN PLANTERS; Nathaniel Drake, Newton, New Jersey; patented February 2, 1858; re-issued December 14, 1858.

Claim—1st, Operating the seed valves from the traction wheels by means of the rods or weights and cams, arranged as set forth. 2d, The agitator, arranged with relation to the seed boxes and valves, as set forth. 3d, The rib attached to the upper valve, constructed and operating as shown. 4th, Combining with one of the

weights which operate the valves, or its equivalent, a cam-shaped gear wheel corresponding in form with the cams which operate said weights. 5th. Extending the chains which operate the valves down under the pulleys back of the axle, so as to obviate the slackening and taking up of the chains by the vibrations of the ploughs and their attachment.

4. ORGANS; William Sumner, Worcester, Massachusetts; patented February 28, 1854; re-issued December 14, 1858.

Claim—The combination or arrangement and connexion with the keys, of a mechanism which shall enable the extreme key touched on either side, or both when operating itself, shall prevent all the others from operating in the stop or stops, connected therewith in the manner set forth. Also, controlling and operating the escape valve by means of friction on the arm, or its equivalent, in the manner set forth.

5. THE MANUFACTURE OF ELASTIC CLOTH; Horace H. Day, Assignee of Richard Solis, City of New York; patented November 7, 1849; re-issued December 14, 1858.

Claim—The new elastic cloth described, consisting of a woven textile material (or cloth), having the threads of the warp oblique to the weft, combined with gum elastic or india rubber, so that the two constitute an elastic compound fabric.

6. REAPING MACHINES; C. W. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858.

Claim—The combination of the support or stand for the raker, placed behind the axis of the reel, balanced or sustained with the raker thereon by the driving wheel, with the reel and with the short platform. Also, combining with the side draft reel reaping machine, having a reel for gathering the grain to the platform, a stand or seat for the raker fixed firmly upon the platform of the machine, so as to enable the raker securely to get at the grain as deposited on the platform by the reel, and deliver and lay it properly on the ground, from a single or short platform, out of the return track of the horses, in such table gavels for being bound into sheaves. Also, the combination of the reel for gathering the grain to the cutting apparatus, and depositing it on the platform, with the stand or support for the raker, or the equivalent thereof, to enable him with ease and celerity regularly to remove the grain from the machine, and lay it on the ground out of the return track of the horses. Also, the construction of the stand or support for the raker, on the frame or platform of the machine, so that it gives to the raker such lateral and forward support to his body when standing at work that he may have free use of his arms and the upper part of his body to remove the cut grain from the platform, while at the same time he is so held fast that he cannot be thrown upon the reel nor prevented from performing his functions by the jolting of the machine as it moves over the uneven ground.

7. SHEARS; Joseph A. Braden, La Grange, Georgia; patented September 21, 1858; re-issued Dec. 28, 1858.

Claim—The construction of scissors or shears with their blades in separate pieces from the handles, and fitted to the handles with stems and sockets.

8. LOOMS FOR WEAVING FIGURED FABRICS; George Crompton, Worcester, Mass.; patented Nov. 11, 1854; re-issued December 28, 1858.

Claim—Combining with hook jacks which are connected with the harness, and with the mechanism for operating them to open the shed, a pattern chain or cylinder constructed with two or more patterns, and operated so that either of the patterns can be made to act on the hook jacks to place them in the required position to be operated upon by the mechanism for operating the shed. Also, in combination with a pattern chain, arranged with two or more patterns in the direction of its length, the mechanism for changing the movements of the chain to effect the changing of the pattern. Also, placing two or more patterns upon the rods of a pattern chain side by side, and operating them in succession by vibrating the chain laterally. Also, pivoting the lifting and depressing rods at one end, the other being made adjustable. Also, moving the rods or jacks out of contact with the rollers on the pattern chain, before the chain is moved by means of what are termed the vibrating fingers, or the equivalents thereof.

9. STEAM STOVE; J. L. Sutton, Norristown, Pennsylvania; patented July 20, 1858; re-issued Dec. 28, 1858.

Claim—Combining two or more concentric chambers, connected together and arranged in respect to each other, with a boiler attached to an ordinary stove, for the purpose specified.

10. MACHINERY FOR CUTTING SCREWS; H. A. Harvey, Assignee (through mesne-assignment) of Thomas W. Harvey, late of City of New York; patented May 30, 1846; re-issued December 28, 1858.

Claim—1st. The combination and arrangement of two inclined rollers, one or both rotating, and placed at a sufficient distance apart to permit the shanks of the blanks to hang therein freely suspended by their heads and for the purpose of arranging the blanks (when presented in a promiscuous mass) all in a row, with their heads up, and causing the row to travel to the lower end, and to be delivered one by one. 2d. Combining with the delivery end of the inclined rollers, or equivalent ways, for supplying the blanks in order, a delivery and check slide, and a receiving and conducting tube, or equivalent therefor, to receive the blanks from the row, deliver them one by one, and conduct them to the place where they are required for after operations and at the periods required. 3d. Combining with the receiving and conducting tube, a transferer, or equivalent therefor, to receive the blanks from the conductor and transfer them to the mandrel or place where they are to be subjected to the cutting action. 4th. Combining with the mandrel or spindle, and with suitable means for holding the screw blanks in line, a sliding twin screw and spring, or equivalent therefor. 5th. Governing the motions of the chaser towards and from the axis of the blank, by combining the chaser with a carriage and sway bar moved by a cam, and also connecting one end of the sway bar with an adjusting slide, when this is combined with a chaser or chaser head, whereby the amount of taper to be given to the screw can be regulated at pleasure. 6th. Changing the directions of the various cam grooves by means of sliding switches, operated by sliding rods within the hollow cam shafts, and shifted by an index cam, by which the various changes of the motions of the machines are effected. And finally, making the cam which operated the sway bar adjustable on its shaft, for the purpose of adjusting the motions of the chaser to the length of the blank, to insure the proper formation of the point of the screw.

11. GAS BURNERS; J. R. Foster, Boston, Mass., Assignee of A. H. Wood; patented September 21, 1858; re-issued December 28, 1858.

Claim—1st. The flame spreaders, consisting of the ring pieces extending outwardly from the gas orifice. 2d. The heaters, combined with the jet gas burners. 3d. Combining with the jet gas burner a draft cone, the top of which terminates at or near the level of the gas orifice.

DESIGNS.

1. METALLIC COFFIN; Wm. H Forbes City of New York; dated December 7, 1558.

2. COOKS' STOVES; G. D. Sprecher, Lancaster, Pennsylvania; dated December 7, 1858.

3. PARLOR STOVES; Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated December 14, 1858.

4. COOKS' RANGES; Garrettson Smith and Henry Brown, Assignors to G. Abbott and A. Lawrence, Philadelphia, Pennsylvania; dated December 14, 1858.

5. BOOK MARKS; Wm. B. French, Charleston, Massachusetts; dated December 14, 1858.

JANUARY 4.

1. AUTOMATIC BOILER-FEEDER; Henry B. Adams, Brooklyn, New York.

Claim—The arrangement and combination of the chambers, shell, and adjustable weight. Also, the combination of the valves with the chambers, for the purposes described.

2. MANUFACTURE OF UMBRELLA RINGS; Jonathan Ball, Elmira, New York.

Claim—An umbrella ring having the ends of the ribs or the stretchers and the wire to confine them cast within.

3. GRINDING MILLS; Thomas Bennett, City of New York.

Claim—The adjustable conical shell, in combination with the grinding cone, placed or secured upon a shaft having no end play or longitudinal or adjusting movement. Further, in combination with the adjustable shell and cone, the cob-cutter permanently attached to the shaft, and having its shell fitted over the end of shell, for the purpose set forth.

4. ELASTIC SADDLES; Lewis Bishop, Talladega, Alabama.

Claim—A saddle having a seat suspended on springs, by means of loops and eyes, and otherwise made as described.

5. CORN SHELLERS; Michael Bomberger, Hummelstown, Pennsylvania.

Claim—So arranging the rollers (provided with helical springs), in combination with the loose rings, as to operate in the manner set forth. Also, the employment of the loose bar when arranged with rollers, helical springs, adjusting bars, and shelling cylinder, substantially as described.

6. HORSE RAKES; WM. H. Brown, Middletown, New York.

Claim—The arrangement and combination of the segment rack, toothed sector and arm, rod, lever, and frame, as described.

7. HARVESTERS; A. C. Brownlick, Buffalo, New York.

Claim—The axle, in combination with the pinions, shaft, and pillow block, constructed substantially in the manner described.

8. SEED PLANTERS; Joel Bryant, Brooklyn, New York.

Claim—In connexion with the cultivating plough, the seed-planting apparatus consisting of the drill plough, seed box, seed slide, driving rod, covering wheel, and sod-clearer, substantially as described.

9. APPARATUS FOR HOISTING AND DUMPING COAL; W. B. Culver, Scranton, Pennsylvania.

Claim—The arrangement and combination of the rod, bars, bail, and inclined guides, as described.

10. ROCKING CHAIR; David Buzzell, Charlestown, Massachusetts.

Claim—In combination with the chair-stand or frame, the movable leg-rest, and the sliding foot applied to such leg-rest, a mechanism by which, when the leg-rest is moved or swung upon its fulcrum or bearings, the sliding foot-rest shall be moved on its supports either toward or away from the seat. Also, the combination of the foot levers and the rockers applied to the chair or seat frame, and so as to operate together. Also, the combination of the toggles, the lifting levers, and their connexions with the foot levers and rockers, the same being for the purpose of so operating the said rockers and levers as to cause the chair to be supported on the ground or floor either by the two rockers or the four foot levers. Also, so combining a foot-rest with a movable or turning leg-rest, that the former shall be movable relatively to the latter, as specified.

11. COTTON CULTIVATORS; Calvin Cannady, Indianapolis, Indiana.

Claim—1st, The two shares or blades when placed obliquely with each other, pivoted to their respective standards and adjusted by the rod, nut, and fork. 2d, The employment or use of the reciprocating hoe attached to the bar, which is connected with the rod, the hoe being operated through the medium of the cam, and spring, in connexion with the pin and springs, so that the transverse movement of the hoe relatively with the row of the plants will be obtained, and also of a vertical movement to allow the hoe to clear the plants when passing over them previous to each thinning out stroke. 3d, The lever, when applied to the rod and used in connexion with the thinning hoe, substantially as set forth.

12. CARPET FAN SWEEPER; Augustus C. Carey, Lynn, Massachusetts.

Claim—The use of a fan for the purpose of sweeping the carpet or other surface, in place of the revolving brush heretofore employed for the purpose.

13. COOKING RANGE; Gardner Chilson, Boston, Massachusetts.

Claim—As my improved arrangement of flues against the bottoms, the outer sides, the tops, the inner sides, and in rear of the two ovens, whereby the smoke after passing over the tops of the two ovens, or either, is made to descend between them, and pass out into the back flue, in manner as described; and with the said arrangement of flues or the parts thereof to which the same specially belong, or in other words, the top and diving flues of the two ovens, I claim the arrangement and application of a curved valve and its arched recess Also, the protector plate, as combined and arranged with reference to the fire-place, the two ovens, and the flue between the two ovens, and so as to support the ovens. Also, the described mode of making the upright flue leading from the fire-place or boiling chamber to the flue space about the oven, such being made with a reflecting back and tapering sides, and in other respects substantially as specified. Also, the expansion safety plate as arranged with respect to the fire-place, and applied on the top plate of the boiling chamber, in the manner specified.

14. SMUT MACHINES; Everard M. Clark, Lancaster, Pennsylvania.

Claim—The diagonal grooved wings or beaters, the upper and lower grooved wings or beaters, the two sliding valves on the bottom of the machine, for regulating the draft, when combined substantially as set forth.

15. BILLIARD CUE TIPS; H. W. Collender, City of New York.

Claim—A cue leather or cue tip, coated on its flat surface with a soluble gum or cement, as described.

16. CONSTRUCTION OF SPECTACLES; John Burt, Hartford, Connecticut, and William W. Willard, Syracuse, New York.

Claim—The employment of the link joint to the nose piece. Also, the construction and arrangement of the short bows, springs, cup, or pads, substantially in the manner described.

17. BANDBOXES; George H. Dickerman, Boston, Massachusetts.

Claim—The combination of a removable standard with the paper bandbox, arranged substantially in the manner described.

18. CULTIVATORS; John B. Duane, Schenectady, New York.

Claim—The arrangement and combination of the frame, D, having wheels, g, bar, F, wheel, G, bar, E, and frame, A, as described.

19. ESCAPEMENT FOR TIME-KEEPERS; John W. Einhaus, City of New York.

Claim—The use of a triangular-shaped pallet lever for an escapement pallet for clocks, watches, &c., with an escapement wheel, constructed in the manner set forth—but irrespective of such use of my block pallet, I make no claim to the construction of the escapement wheel of itself, as my invention relates exclusively to the use and application of the block pallet.

20. SPADING MACHINES; George B. Field, St. Louis, Missouri.

Claim—Propelling the shovels by means of single cranks attached to handles, and guided by adjustable arms or levers, so that the lower end of the shovels, when in motion, shall run in separate lines or furrows, substantially as described.

21. WASHING MACHINES; Micah Gillam, Alba, Pennsylvania.

Claim—The beaters or lifters arranged upon the rocker shaft within the half cylindrical tub, lined with anti-friction rollers, the rocker shaft being operated by the lever, vertical shaft, and connecting rods.

22. MEANS OF OPERATING CARRIAGE BRAKES; Wm. Gourley and Isaac Krebs, Winchester, Virginia.

Claim—The construction and application of the compound or double lever, and the crank-shaped rubber rod or brake bar, and T-shaped spring, when combined and operated substantially as described.

23. MACHINE FOR SAWING LATHS; E. H. Hancock, Augusta, Georgia.

Claim—1st, The combination of the peculiar spirally-toothed feed rollers, G G′, ordinary toothed or fluted feed rollers, H H′, and obliquely set guide or gauge, when arranged relatively to the saws, for the purposes set forth. 2d, The combination of the rollers, G′ H, swinging frames, shaft, pinions, spur-wheel, and cog-wheel, substantially as set forth. 3d, The arrangement of the swing table bearing a portion of the machinery with respect to the frame, and the rest of the machinery thereon, as set forth.

24. BEE-HIVES; J. S. Harbison, Sacramento, California.

Claim—1st, The graduating chamber, in combination with the curtain and ventilating passages, whereby air is admitted without light into the hive. 2d, Providing the adjustable sectional comb frames with the flexible metal clamps, when the frames are constructed and arranged in the manner described. While not claiming, broadly, the removal of a tier of boxes at one operation, nor the boxes of a tier separately, by means of a clamp, irrespective of the mode of construction, I do claim:—3d, The device composed of the parts, L f d c, in combination with a horizontal tier of boxes, arranged and operated as described.

25. COFFEE POTS; J. W. Hedenberg, St. Louis, Missouri.

Claim—The application of the chimney or pipe to the open space between the coffee pot and the condenser, for the purpose of causing a current of cold air to pass between the coffee pot and condenser, as set forth.

26. ROTARY HARROWS; Charles Howell, Cleveland, Ohio.

Claim—1st, The arrangement and combination of three rotary harrows, when the axis of each is inclined, in the manner described. 2d, The arrangement of the hook in relation to the front harrow, when combined with two harrows in the rear, arranged to operate in the manner set forth.

27. METHOD OF OPERATING THE VALVES OF PUMPING ENGINES; L. J. Knowles, Warren, Massachusetts.

Claim—1st, Controlling the motions and positions of the plunger exclusively by steam admitted from the steam chest, and by suitable exhausts. 2d, The described arrangement of the induction ports with respect to the exhaust ports, and with respect to the throw of the plunger, for the purpose specified. 3d, Admitting a quantity of steam before the advancing plunger through the passages, for the purpose of arresting its motion. 4th, The secondary exhaust ports, operating as described. 5th, The peculiar construction of the main valve, whereby the pressure upon the same is relieved, as it passes the centre of its throw, and the piston is caused to start more gradually, as set forth.

28. MEANS OF OPERATING CARRIAGE BRAKES; Isaac Krebs, Winchester, Virginia.

Claim—The levers with movable fulcrum, the sliding adjusting connexion rod and tap, the slotted clip or fulcrum support, and the spring rubber, when constructed as described.

29. MACHINES FOR SOWING GUANO AND OTHER FERTILIZERS; J. H. Leach, Oakville, Maryland.

Claim—The arrangement of the covering section of the drill within the frame of the roller section—and in connexion therewith, the arrangement of the box between the hopper and distributing spout, the box being attached to the hopper by pliable or elastic material, and being vibrated with the spout by the toothed wheel upon the axle, as described.

30. RAILROAD SLEEPING CARS; T. Luce and J. H. Morrison, Detroit, Michigan.

Claim—The folding berth bottoms attached at each side of a central partition within the body of the car, in connexion with the double row of single seats at each side of the car, with a passage way between them, the innermost row of seats at each side of the car being provided with falling backs.

31. RAILWAY ALARM; Henry Maule, Philadelphia, Pennsylvania.

Claim—The employment of the lever, or its equivalent, in combination with an extra rail and with the steam whistle, substantially as described, for sounding the steam whistle at any desired part of the road.

32. CUTTING AND PUNCHING IRON; A. J. Peavey, South Montville, Maine.

Claim—The cylindrical die-box, in combination with the circular punch socket, both punch and die being by their means capable of revolution upon their axes and adjustment to the required angles of the teeth of the saw to be gummed. I do not claim the dividing plate and the parts necessary for its convenient operation,

nor operating the punches by lever and cam, separately considered. But I do claim the combination of the dividing plate and its appendages, with the punching apparatus, in the manner and for the purpose specified.

33. SPOKE MACHINE; N. Olney and C. H. Kellogg, Amherst, Massachusetts.

Claim—The expanding cutter heads in connexion with the guides or patterns attached to the reciprocating carriage, in which the stick to be operated upon is placed; the guides or patterns actuating the cutter heads respectively by means of the mechanism. Further, in combination with the expanding cutter heads, and the guides or patterns on the carriage, the circular saws fitted in the frame, operated automatically by the carriage, substantially as set forth.

34. CORN HARVESTERS; R. C. Mauck, Conrad's Store, Virginia.

Claim—1st, The bearing wheel, arranged substantially as set forth. 2d, The combination of the bearing wheel and the rest block for submitting the stalk to the knife in the best manner to effect the cut. 3d, Guiding the machine by the passage of the groove over the stumps of the cut products.

35. REVOLVING FIRE ARMS; C. S. Pettengill, New Haven, Connecticut.

Claim—1st, Combining the hammer and the rotating dog with the trigger, by means of a forked tumbler and a cam working on the same pin, the said cam being formed with a notched tail to engage and operate in combination with a horn on the trigger, substantially as set forth. 2d, The bent dog, applied as described, on a fixed conical steed on the centre of the rear of the breech, supported and combined with a cam on the tumbler pin, to operate substantially as described. 3d, The arrangement of the helical main spring upon a bolt which is jointed to the hammer, and which slides through a fixed guide in the rear thereof, substantially as described.

36. MACHINE FOR DITCHING, GRADING, &c.; Wm. Provines, Columbia, Missouri.

Claim—The arrangement and combination of the elevators, rods, shaft, f, disk, and shaft, e, substantially as described.

37. MACHINERY FOR POINTING THE TEETH OF HAIR COMBS; C. B. Rogers, Deep River, Connecticut.

Claim—Forming the recesses at the centre and from the edges of the periphery of the wheel toward its centre, so that each recess shall extend only partially across the periphery of the wheel, and still cutting surfaces be formed entirely across it, without breaking or dividing the screw-thread entirely across the wheel at any one point, substantially as set forth.

38. SIFTING SHOVELS; Paul A. Sabbaton, Albany, New York.

Claim—A screening shovel, composed of malleable cast iron, and otherwise made as described.

39. GRINDING AND CRUSHING MILLS; Gelsten Sanford, Poughkeepsie, New York.

Claim—1st, The arrangement and combination of a conical grinding surface with a concentric shell, composed of stationary and adjustable wedges or staves, which are provided with a means of adjustment, substantially as described. 2d, The arrangement of the projecting surfaces of the cone, so that by reversing the direction of the rotation of the cone, small or large bodies may be crushed and ground in the mill.

40. LAMPS; Wm. F. Shaw, Boston, Massachusetts.

Claim—The foraminous deflector described, operating in the manner set forth. Also, the foraminous deflector, in combination with the perforated bottom air chamber, as set forth.

41. SEWING MACHINES; Isaac M. Singer, City of New York.

Claim—Placing the spool within the shuttle without any attachment, so that the heads thereof shall run in contact with the case of the shuttle, to give the requisite drag. Also, in combination with the shuttle case, and the spool placed therein without any connexion, the employment of the spring plates to form spring bearings for the pivots of the spool, as set forth. Also, the shuttle case and spool placed therein without any attachment, in combination with the enclosing plate and the face of the shuttle race, by means of which combination the spool is held in place by simply placing the shuttle in its race.

42. FRANKLIN STOVES; David Stuart, Philadelphia, Pennsylvania.

Claim—Forming the fire back of such stoves by the front wall of a cell or chamber, around or on both sides of which the draft passes, and through which the air circulates, said cell or chamber being constructed and connected with the stove in the manner set forth.

43. LITHOGRAPHIC PRINTING PRESS; Wm. Hermann Stuble, Boston, Massachusetts.

Claim—1st, The cylinder of rollers, in combination with a revolving tympan and scraper, operating as set forth. 2d, The method of interrupting the motion of the gears and of again engaging them with the rack, by means of cams, lever, and pin, operating in the manner set forth. 3d, Hanging the parts which operate the scraper on springs, in the manner specified.

44. CULTIVATORS; George W. Tolhurst, Liverpool, Ohio.

Claim—The arrangement of the flanched quadrants, pivots, clamp hook, braces, teeth, and rigid frame, in the manner described.

45. CATCH FOR HANGING DRAPERY; Alonzo and Cyrus A. Warner, Bristol, Connecticut.

Claim—The spring catch, constructed as specified.

46. MODE OF OPERATING DRAIN PLOUGHS; Daniel Watson, Newport, Ohio.

Claim—Combining with the crab or anchor and the plough, traveling capstans, which are connected together by a rope or chain, as represented, for the purpose of working said plough.

47. CORN SHELLER; Wm. Wells, Boston, Massachusetts.

Claim—The arrangement and combination of the shelling wheel, guide, clearer, and weighted or spring presser, constructed in the manner described.

48. COPYING PRESS; Alonzo Whitcomb, Worcester, Massachusetts.

Claim—When the screw is arranged to pass through and traverse a nut in the cross-bar, I claim connecting the screw and platen with each other in presses, by means of a cap on the upper side of the platen, with a spiral thread in its interior to correspond with the thread on the lower end of the screw, as described.

49. SCREW PROPELLER; Benjamin F. Bee, Harwich, Assignor to self and James A. Woodbury, Boston, Mass.

Claim—The combination of the cylinder with the longitudinal plates, as described.

50. HORSE RAKES; B. Bridendolph, Assignor to self and O. K. Borey, Clear Spring, Maryland.

Claim—The arrangement of the handles, rake head, shafts, runners, and links or rods, for the purpose set forth.

51. Attaching Handles to Cutlery; Matthew Chapman, Assignor to the J. Russell Manufacturing Co., Greenfield, Massachusetts.

Claim—Placing the handles in the rough on the tangs of the implements, with or without the rivets, and compressing the same while on the tangs into proper form by means of dies, as set forth.

52. Manufacturing Webbing; James C. Cooke, Assignor to the Russell Manufacturing Company, Middleton, Connecticut.

Claim—A fabric or belting made not only of two or more sets of body warps, and a single filling thread passed through the decussations of the said warps, alternately or otherwise, but with confining warps arranged and crossed on the filling, and between the body warps and at various or numerous intervals between the two edges of the fabric, so as to bind together the cloths made by the body warps, and form them with no straight or continuous parallel ridges.

53. Method of Bending Wood; Robert Fitts, New Ipswich, New Hampshire, Assignor to C. and G. C. Winchester, Ashburnham, Massachusetts.

Claim—Bending a piece of wood around a fixed form, by means of the series of blocks, levers, and connecting bars. Also, in combination with the above, the spring face plate attached to the blocks, in the manner specified.

54. Bridge Walls in Boiler Furnaces; Wm. G. Hamilton, Assignor to John C. Hamilton, City of New York.

Claim—The hanging of the bridge wall upon an axis, in the manner described, or equivalent, by which it is made capable of being folded down out of the way, and also the making of the axis hollow, terminating with an opening forward, as described.

55. Electro-magnetic Telegraphing; David E. Hughes, Assignor to the American Telegraph Company, City of New York.

Claim—Introducing into that portion of the electric current which passes to the opposite pole of the machine, at the station where the operator is working, a retarder, such substantially as herein described, whereby said portion shall not reach the near ground plate until after the other portion of the same current shall have passed over the line wire and reached the distant ground plate, whereby said current is enabled to flow through the machine situated at the place of the operator, as aforesaid, without setting said machine in motion, substantially as described.

56. Manufacturing Corsets and Bustles; Damase Lamoureux, Assignor to Alexander Douglas and Samuel S. Sherwood, City of New York.

Claim—A corset and bustle, when constructed in the manner described.

57. Looms; Stephen C. Mendenhall, Assignor to Isaac Lamb, Richmond, Indiana.

Claim—1st, The treadle roller, carrier, and spring, in combination with the scroll cam, arranged in the box, for the purpose of operating the treadles substantially in the manner described. 2d, The hook having an adjustable and hinged attachment to the breast-beam, when combined with a set-screw to determine its position, and operating in the scroll cam, in the manner set forth. 3d, The combination with the treadle of the graduated series of mortises and pin, for the purpose of regulating the width of the shed. 4th, The combination of the picker spring, sliding catches, triggers, and straps, for the purpose of throwing the shuttle, as set forth. 5th, The combination of the double eccentric pulley and straps with the set-screws, for the purpose of expanding the picker spring in such a manner as to equalize the power at each forward motion of the lay or batten.

58. Lasts; Goodloe H. Taylor, Shelburne, Assignor to self and Wm. Sherwin, Shelburne Falls, Mass.

Claim—So pivoting the hook or lever as that the strain shall come upon said pivot and not upon the spring, by which means I effect a better and more certain fastening.

59. Sealing Cans and Bottles; James D. Willoughby, Carlisle, Pennsylvania, Assignor to C. M. Alexander, Washington City, D. C.

Claim—1st, The arrangement of the disks, screw, and top with the rubber, in such a manner that when the rubber is compressed its periphery will press tightly against the insides of the can or bottle mouth, while its centre presses against the rod or screw, for the purpose of effectually excluding the air. 2d, The subject of the first claim in combination with the neck of the bottle or can, as constructed.

60. Burners for Vapor Lamps; Ephraim D. Rosencrantz and Willard H. Smith, Assignors to said Rosencrantz and Barton E. Clark, City of New York.

Claim—The employment of a tube for holding the wick, when provided with a plate and perforations, for the purpose set forth. Also, the employment of a cap or heater having perforations tangential to its periphery, when used with a wick tube, in the manner set forth.

61. Coffins; Charles E. H. Richardson, Philadelphia, Pennsylvania.

Claim—The construction of a coffin or casket, made air and moisture tight by a double lining of cloth and cork, prepared and combined in the manner described.

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62. Composition for Friction Matches; Wm. Paggett Allen, Dubuque, Iowa.

Claim—1st, The combination of phosphorus with the substances marked B and C, in the proportions and manner set forth. 2d, The combination of phosphorus with the substances marked D and E, in the said proportions and manner. 3d, The combination of phosphorus with the substances marked A, in said proportion and manner.

63. Roller for Expressing Water from Clothes; John Allender, New London, Connecticut.

Claim—A roller consisting of a spirally coiled spring, arranged on a shaft or roller made smallest in the middle (to allow the spring to yield), covered with india rubber, or some flexible material, that will yield or bend readily as the spring yields to the cloth, clothes, or other article being squeezed by the rollers.

64. Door Spring; James Barkley, Weston, Missouri.

Claim—The employment of the spring which shall be provided with a hook at one end, and which shall be secured to the casing at the other by means of two half staples, thus making a spring, which is adjustable to both ends, capable of being detached from either the door or casing in a moment of time.

65. CANTEENS; **Benjamin Beers, New Fairfield, Connecticut.**

Claim—The combination with said canteen, of the additional vessel made by hollowing out a piece of wood and inserting its edge in a groove in the end or head.

66. METHOD OF SECURING TOGETHER THE SIDES OF CAST METAL COLUMNS; **A. J. Bowers, Richmond, Virginia.**

Claim—Securing the plates or sides of metal columns together by means of the projections, ledge provided with notches, and the wedges, as described.

67. WATER-CLOSET; **Thomas Birch and Lewis Bradley, Hartford, Connecticut.**

Claim—The arrangement of the metallic rim, arm, disk, cap, and lever, in the manner described.

68. ARTIFICIAL MANURE; **Duncan Bruce, Paspebiac, Canada.**

Claim—The manure manufactured by the described process, the animal matters being first decomposed in the manner set forth, and subsequently disinfected by charred shale, or its equivalent.

69. SCHOOL DESK AND CHAIR COMBINED; **George Buchanan, Hickory, Pennsylvania.**

Claim—A seat pivoted near its front edge to a stationary frame, and hinged near its near edge to a movable back, and having its arms pivoted by their rear ends to the movable back, and hinged to the stationary frame.

70. DEVICES FOR SETTING LATERALLY CIRCULAR SAWS; **J. D. C. Carpenter, Cincinnati, Ohio.**

Claim—The rock shaft connected with arms and acting as an eccentric or as two cranks for adjusting the saw shaft laterally.

71. BURGLAR-PROOF SAFE; **John B. Cornell, City of New York.**

Claim—Combining a cast iron door frame with the wrought iron portions of the frame of a safe, in such a manner that the molten iron, which is afterward, whilst in a melted state, combined with the said safe frame will form a burglar-proof protecting casing around the said door frame.

72. LATHE ATTACHMENT FOR FINISHING DENTAL PLATES; **Elijah H. Danforth, Jamestown, New York.**

Claim—The combination of the mechanical devices specified, consisting of the piston, bed-pieces, boxes, slides, and the crank. Also, the adjustable crank as it is arranged and attached to the specified parts of this machine, as set forth.

73. SODA WATER APPARATUS; **Thomas Daniels, Toledo, Ohio.**

Claim—1st, The arrangement of the whole apparatus, the syrup cans being elevated above the refrigerator, which is provided with the group stop cock. 2d, The arrangement of the tubes for conducting the syrups and the water to the top of the ice chamber, without cooling them, and concentrating the cooler portions of these liquids below the ice near the place of discharge.

74. METHOD OF SECURING THE CYLINDRICAL BALANCE SPRINGS OF WATCHES; **A. L. Dennison, Waltham, Mass.**

Claim—Placing the cylindrical spring beneath the balance and between it and the fork, and cutting away the upper plate to furnish room for its accommodation.

75. LEWIS FOR ATTACHING TACKLES TO BLOCKS OF STONE; **Eugene Duchamp, St. Martinsville, Louisiana.**

Claim—A lewis composed of a shell, air pump, nozzle or tube, packing, staple, and otherwise made as described.

76. ENDLESS CONVEYORS FOR REMOVING EARTH; **Samuel Falwell, Memphis, Tennessee.**

Claim—1st, The series of sectional cars in an endless connexion, each car being provided with terminal or track wheels, and intermediate wheels of varying and lesser diameter than the track wheels and shoulder stops, or equivalents thereof. 2d, The combination of such cars with an upper and lower track and wheels, as set forth.

77. ELECTRO-MAGNETIC FIRE ALARM APPARATUS; **Moses G. Farmer, Salem, Massachusetts.**

Claim—The circuit wheel and the crank or handle by which it is actuated, in combination with the key and the electro-magnetic circuit, operating to send a definite signal from a sub-district to the central station. Also, the method of completing the circuit, when the door of the signal-box is closed, through the springs, as set forth.

78. DOOR SPRING; **John S. Gray, City of New York.**

Claim—The combination of the socket, bolt, and hold-fast, with the torsion spring, constructed as set forth.

79. WASHING MACHINE; **J. R. and J. S. Haldeman, Bloomington, Illinois.**

Claim—1st, The arrangement of the springs and supporting beams, in connexion with the sliding frame that carries the lower series of fluted rolls. 2d, The clasp, constructed as set forth. 3d, The sliding standard, or its equivalent, in combination with the rack bar and pawl, as set forth.

80. WASHING MACHINE; **Eden S. Howell, Hope, New Jersey.**

Claim—1st, The combination of the live rubber with the horizontal sliding and rotating shaft, vibrating pressing lever, and ratchet, or its equivalent. 2d, In combination with the rocking and pressing rubber, the perforated rubber partition. 3d, The detachable lever and bar, substantially as described.

81. FLAIL CAPS; **Thomas J. Hubbard, Hamilton, New York.**

Claim—The construction of flail caps, of casting metals in separate parts or sections, with the lip or crescent tongue formed upon the interior thereon, as described.

82. PREPARATION OF RESINS; **Edward Hunt and Henry Davis Pochin, Talford, England; patented in England, April 27, 1858.**

We are aware that stills and steam worms, capable of distributing small jets of steam, have been before used in a somewhat similar way for the treatment of oils and fatty matters, and for improving the quality of resin oil obtained from substances similar to those used by us in the processes described. But such a process has never, so far as we can ascertain, been applied to any such substances as are proposed to be operated upon by our processes, for the purposes of obtaining the resinous and solid products specified as the result of our said processes. We therefore

Claim—The new article of commerce specified, as produced by the processes mentioned, or by any similar mode or process, said articles or products not having been hitherto known in commerce or used in the arts.

83. SAUSAGE STUFFER; R. V. Jones, Johnstown, Pennsylvania.

Claim—The piston rod and supporting recess, constructed as described, in combination with the pronged nut and screw.

84. TREATMENT OF INDIA RUBBER; Henry W. Joslin, Trenton, New Jersey.

Claim—The use and employment of sulphuret of zinc, either artificial or native, substantially prepared by the aforesaid process described, in combination with india rubber, for the purpose of curing or vulcanizing it in form and manner as set forth, without the use of free sulphur in any way in combination with the rubber.

85. STUMP EXTRACTORS; John L. Knowlton, Glassborough, New Jersey.

Claim—The lever with its catches, in combination with the hauling chain and springs, or their equivalents, when the said chain is guided so as to prevent it from twisting or from moving laterally or vertically.

86. HORSE COLLARS; Oliver Lapreniere, City of New York.

Claim—A horse collar, having its lower part provided with a metallic tube, to give form to and hold the packing.

87. ROOFING COMPOSITIONS; Henry Lester, Cincinnati, Ohio.

Claim—A composition for roofing, and similar purposes, produced from the mixture of the ingredients described, in the proportions and for the purposes set forth.

88. TAPER GAUGE FOR CARPENTERS; John Marvin, Bellport, New York.

Claim—The employment and use of a conical roller applied to a block or a stock of the gauge, and connected with a rack or the pencil bar, in the manner shown, or in any equivalent way, so that the roller will be rotated as the gauge is shoved along, and the bar moved longitudinally by the rotation of the roller, so as to produce the desired result. Further, in combination with the conical roller, the adjustable band and fence, applied to the block or stock, for the purpose of regulating the degree of taper of the line, substantially as described.

89. METALLIC CARTRIDGE CASES; Edward Maynard, Washington City, D. C.

Claim—An improved metallic cartridge, composed of a brass cup combined with an exterior steel disk, substantially as set forth.

90. INDIA RUBBER HOSE PIPES; Charles McBurney, Roxbury, Massachusetts.

Claim—A semi-elastic composition pipe, compounded of the ingredients and in the proportions substantially specified, when vulcanized, as set forth.

91. MACHINE FOR SAWING SHINGLES FROM THE BOLT; Alex. R. McCans, Ashley, Missouri.

Claim—In combination with a saw hung in a swinging arm, the spur, rack, and sliding bar, for drawing said saw through the bolt, to sever the shingle therefrom, and to trip and allow the saw to fall back for the next similar operation. Also, in combination with a pivoted table for holding the bolt, the shifting bars, for bringing the bolt up to the saw in such a manner as to alternately reverse the ends of said bolt, from which the butts and points of the shingles are cut, as set forth.

92. RAILROAD CAR SEATS; Thomas E. McNeill, Philadelphia, Pennsylvania.

Claim—1st, Jointing the ends of the arm-rests to the ends of the upright standards at the corners of the seats, and providing their opposite ends with sliding bolts or bars, and right-angled plates, and half pivots or pins for enabling their attachment, when in a horizontal position, by the bars and their upright elevation, to form a support for the hinged portions of the backs, when the seats are swung round upon the crank bars. 2d, The combination of the hinged board, with the projecting ledges on its surface, with the box-like frame forming the rest of the bottom of the seat, next the end of the car in which it can be enclosed. 3d, In combination with the swinging seats, the box-like frames and the platforms, attached to the same by the cranks and jointed bars.

93. STONE-CUTTING MACHINES; George Morgan, Brooklyn, New York.

Claim—The arrangement of cutters of gradually increasing length, in such relation to hammers and to a sliding carriage, that by the action of the hammers on the cutters an incision is made through the whole length of a block of stone, which is placed on the carriage.

94. APPARATUS FOR INCREASING DRAFT OF CHIMNEYS; Antoine Niel, Brooklyn, New York.

Claim—The arrangement of the exterior tube, having the expanded conical and cylindrical portions constituting the chamber of compression, and the contracted annular space between the two tubes above the conical part of the tube with the inner tube, the two tubes bearing the relation to each other as herein set forth.

95. BRIDLE BITS; Antoine Niel, Brooklyn, New York.

Claim—1st, The combination of the griper bars with the bars of the bit of the horse. 2d, Attaching the griping bars by their double-eyed ends and by the screw nuts to the bars, as set forth.

96. SPECTACLE FRAMES; Theodore Noel, Memphis, Tennessee.

Claim—The employment of springs applied to the frame, as specified.

97. RETORTS FOR DISTILLING OIL FROM COAL; James O'Hara, Pittsburgh, Pennsylvania.

Claim—The employment in an upright retort for distilling coal, of a revolving screw, of a circumference smaller than the interior of the retort, so applied that while by its revolution it produces a continuous elevation of the central portion of the charge, it permits and causes a continuous descent of the surrounding portion by gravitation, and thus produces a positive continuous and uninterrupted upward and downward circulation.

98. GAS BURNERS; Albert Ostrander, City of New York.

Claim—The manufacture of gas burners, made of the composition of felspar, quartz, and asbestos, having the peculiar formation of the vents set forth.

99. ARTIFICIAL FORE ARMS; B. Frank Palmer, Philadelphia, Pennsylvania.

Claim—1st, Closing the hand by means of a strap, operated by an attachment to the shoulder of the opposite arm. 2d, The clamp, constructed and operating as described, and applied to the purpose specified.

100. MANUFACTURE OF SUGAR; Edmond Pesier, Valenciennes, France; patented in France, March 29, 1858.

Claim—The treatment of the saccharine juices of plants, in the manner described, by the use of alcohol, in combination with other special agents.

101. Artificial Arm and Hand; **B. Frank Palmer, Philadelphia, Pennsylvania.**

Claim—1st, Giving a sinuous course to the flex or tendons of the fingers, by means of the sheaves, for the purpose described. 2d, Opening the fingers by means of extensor tendons, antagonizing the flexors by means of springs. 3d, The wrist-joint, constructed as described, of a ball and socket held in contact by cords, arranged and operating as specified. 4th, Giving a soft and elastic covering to the shaft and the wrist, for the purpose of imitating the changes of form which take place in the natural arm, during the movements of the radius and the play of the pronator and supinator muscles. 5th, The mode described of attaching the arm to the body.

102. Peg Cutters; **E. R. Pease and R. R. Hayman, Poughkeepsie, New York.**

Claim—The described machine for cutting off or removing pegs and nails from the insides of boots and shoes.

103. Inestand; **G. M. Prentiss, Worcester, Massachusetts.**

Claim—An inkstand, having a plunger, constructed and fitted as described.

104. Corn Harvesters; **Isaac Reamer, Conrad's Store, Virginia.**

Claim—1st, The combination of the elastic lower guide with the adjustable upper guide, when these parts are arranged in the manner described. 2d, The arrangement and combination of guide and swinging clearer for removing the corn from the platform, in the manner described.

105. Detaching Paper from Vulcanized Gum; **Albert C. Richard, Newtown, Connecticut.**

Claim—Subjecting the surface or surfaces of vulcanized india rubber, gutta-percha, or other elastic gum, sheets, valves, belts, or other objects, which have been so vulcanized or cured between or on paper, and to which the paper adheres, to a mechanical process of regular bending and continual elongation, having the continuous effect of drawing or detaching the filaments or atoms of the elastic gum, which adhere to, or which have entered into the pores of the paper, gradually and regularly therefrom and thereout, simultaneously across the whole width of the surface operated upon, in the manner as set forth, or in any other manner producing substantially the same result.

106. Framing Square; **Wm. Ripley, Edgartown, Massachusetts.**

Claim—Framing square made with its bearing ledge, its squaring arms, mitre slots, and mortising slots, arranged together and with respect to a base rule.

107. Machinery for Oiling the Journals of Locomotives; **Stephen Scotton, Richmond, Indiana.**

Claim—1st, The combination of the weighted shaft, the spiral spring, and the box, with the journal of locomotive carriage. 2d, The metal cup, in combination with the box and upright shaft, or their equivalents. 3d, The nut, when combined with the upright shaft and cup, or their equivalents, in the manner specified.

108. Treating Auriferous and Argentiferous Pyrites; **Lewis Solomon, City of New York.**

Claim—1st, Extracting gold and silver from auriferous and argentiferous pyrites, in the manner substantially as set forth. 2d, The application of wood ashes to the roasted ore during the process of grinding, and of soda ash, for the purposes specified.

109. Grinding Surfaces for Mills; **O. W. Stanford, Cincinnati, Ohio.**

Claim—The employment of a system of circular grinding teeth, when arranged in the manner set forth. Also, arranging around the outer surface of the disk intercepting V-shaped teeth, to operate in the manner specified.

110. Trip Hammers; **Casper V. Statter and George W. Wilson, Walnut Grove, Illinois.**

Claim—Arranging a hammer in such relation to an anvil, by means of levers and links, that the same can be operated by means of a hand lever or by foot levers. Also, the arrangement of the hand lever in such relation to the foot levers and to the chisel, that both the hammer and the chisel may be operated by the motion of the hand lever. And in combination with the above described hammer, we further claim connecting the handle of the chisel with the arm, by means of an adjustable rod, so that the cutting edge of the chisel may be accommodated to different thicknesses of iron.

111. Desiccating and Clarifying Cane Juice; **Richard A. Stewart, St. Bernard's Parish, Louisiana.**

Claim—As new in the desiccation and clarification of cane juice, and other liquid or semi-liquid forms of saccharine matter, disseminating throughout the same sulphurous gas, or sulphurous acid gas, for the purposes set forth.

112. Gas Retorts; **H. K. Symmes, Newton, Massachusetts.**

Claim—Dispensing with the mouth-piece of the ordinary horizontal gas generating retort, and dividing the mouth of the retort into two portions, one of which is brought into permanent connexion with the stand pipe, the other being employed for the purpose of charging the retort.

113. Manufacture of Candles; **Joel H. Tatum, City of New York.**

Claim—A candle, having its stock composed of tallow, stearic acid, and gum camphor, with or without bees-wax, in about the proportion specified, and the exterior of the candle covered with a compound composed of stearic acid, gum camphor, and gum damar, or equivalent flux, in about the proportions set forth.

114. Mode of Constructing Slats for Blinds; **Wm. E. Worthen and John J. Althause, City of New York.**

Claim—A sheet metal blind slat or luffer board, made up of the combination of a slit tube, with two thicknesses of sheet metal.

115. Hardening Fatty Substances; **Benjamin C. Tilghman, Philadelphia, Pennsylvania;** patented in England, May 2, 1857.

I do not claim, generally, the process of hardening fatty substances by sulphuric acid, as I am aware that this has been before proposed: but in such cases, the heat employed has been under or above 212° Fah. Now, I have found that the hardening effect of sulphurous acid is very greatly increased by causing it to act upon the fatty substances at more elevated temperatures, preferring from about 350° to 550° Fah., but which may be varied from a little above 212° Fah., to above the distilling point of the fatty substance, and it is to this modification of the process that the part of my claim extends and is confined. I am also aware that it has been before proposed to decompose fatty substances and soaps into fat acids, and to purify fatty substances from mucilage, gelatine, &c., by means of sulphurous acid, and also to subject fatty substances to the action of strong sulphuric acid, whereby sulphurous acid is generated in the fat itself—and I wish it to be understood that I make no claim to any of the above processes.

Claim—The hardening of acid and neutral fatty substances, by subjecting them to the action of sul-

phurous acid at elevated temperatures, either with or without pressure. Also, the use of oxide of copper, or its chemical substitutes, to remove from fat acids the sulphureted impurity produced therein, by treatment with sulphurous acid. Also, the methods of preserving the color of white neutral fats, when treated by sulphurous acid at elevated temperatures, by using the sulphurous acid entirely free from air or oxygen, and by using fats pure and neutral, and free from any mixture of acid, rancid, or decomposed fats.

116. TEMPLES FOR LOOMS; Jeremiah C. Tilton, Sanbornton Bridge, New Hampshire.

Claim—The application of the cloth bearer carrier to its support by a hinge, arranged in manner substantially as described, that is, so as to allow the carrier and its bearer to be drawn backward under circumstances as described.

117. CORN SHELLERS; Artemas B. Vant and Arlon M. Cook, Milford, Massachusetts.

Claim—The combination and arrangement of the smooth revolving pressure plate or wheel, with the convex toothed wheel and guard plates, when constructed substantially in the manner described.

118. HYDROFUZE FABRICS; James Wansborough, Southwark, County of Surrey, England, patented in England, December 13, 1853.

Claim—Securing the flocks, or other finely divided substance, after it has been sifted or spread on to the surface and calendered by applying to the surface thereof a solution of india rubber or allied gum. Also, in combination with the method of securing the flock described, the subjecting of the same to a steaming process.

119. LOCOMOTIVE ENGINES; Ross Winans, Baltimore, Maryland.

Claim—The blast equalizing pipe proportioned to the chimney, and arranged substantially as set forth. Likewise, a blast pipe of less diameter than the smoke pipe, and having a bell mouth, in combination with an exhaust nozzle and the bottom on which the sparks lie.

120. SURVEYING INSTRUMENT; George Windle, Edenburgh, Virginia.

Claim—1st, Attaching the adjusting weight of the magnet case directly to the universal joint on which said case turns and swings. 2d, The arrangement of the pointer which designates the number of degrees at which the movable frame and telescope stand, adjusted on an adjusting screw, which has the surface of its head graduated so as to indicate minutes, in combination with a stationary pointer, and with an extension formed on the pointer, which comes opposite the degrees on the magnet case.

121. STEAM VALVES; John E. Wootten, Philadelphia, Pennsylvania.

Claim—The application of the anti-friction roller, in combination with a diaphragmatic piston, or an equivalent therefor.

122. APPARATUS FOR EVAPORATING; Wm S. Worthington, Newton, New York.

Claim—The arrangement of a series of two or more grated fire-places, a b c, and communicating passages, f g, and flues h h, in a casing, c, on each or either side of a pan or train of pans.

123. ELECTRO-MAGNETIC APPARATUS FOR SETTING WATER ENGINES IN MOTION; Moses G. Farmer, Salem, Assignor to Wm. F. Channing, Boston, Massachusetts.

Claim—1st, The combination of an electro-magnetic escapement with the cock or water valve, and with the detent of a water engine, separately or conjointly, for the purpose of controlling its motion from a distance, especially in its application to a fire alarm telegraph. 2d, The employment of two or more arms, of progressively increasing weight, in combination with a water engine, and with an electro-magnet, or its equivalent, for the purpose of releasing machinery, as set forth—the first of the weighted arms being liberated by the electro-magnet, while the last one of the series releases the machinery, each of the weighted arms being returned to its normal position by the action of the water engine.

124 GAS BURNERS; Wm. Wright, Assignor to self and Frederick Wright, City of New York.

Claim—A gas burner provided with a double flanched cup having openings, and otherwise constructed, substantially as described.

125. AUTOMATIC GRAIN SCALES; Joseph R. Gates, Indianapolis, Assignor to self and Alexander Corey, Shelbyville, Indiana.

Claim—1st, The lever and spring, when used for the treble purpose of operating the cut-off gate, discharging or loosening the bottom valve, and preventing the weights from raising the scale-box and drawing the slide until the bottom is closed, thereby regulating the cut-off and flow of grain, without using the weight of the grain while the same is being weighted. 2d, The combination and arrangement of the spring and weight, m, with the elbow lever, k, connecting rod, j, and lever, i, when constructed as described.

126. MODE OF ATTACHING THILLS TO AXLES; George Kenny, Milford, Assignor to self and Josephus Baldwin, Nashua, New Hampshire.

Claim—The combination of the pressing and locking india rubber tube with the eyes and bolt, with its nut, substantially in the manner described.

127. MACHINE FOR SAWING MARBLE; James Lyon, Assignor to Jesse J. Davis, City of New York.

Claim—The arrangement of the reciprocating bar, adjustable rollers, adjustable frames, and diagonally slatted sides, in relation to each other, and to parts that connect with and guide the saws, for the purposes specified.

128. MANUFACTURE OF EMERY WHEELS AND STICKS; Thomas J. Mayall, Roxbury, Assignor to self and George M. Davis, Boston, Massachusetts.

Claim.—The employment of vulcanized rubber tempered with olive oil, in combination with powdered emery, or its equivalent, for the manufacture of polishing wheels and sticks.

129. ELASTIC DRAW-BAR AND BUMPER; Thomas J. Mayall, Roxbury, Assignor to self and Benjamin F. Cook, Boston, Massachusetts.

Claim—The combined draw-bar and bumper, consisting of the elastic cylinder, the heads, bars, spring, and bolt, constructed as set forth.

130. MOWING MACHINES; Thomas Windell, Assignor to J. B. Ford, James W. Shield, and H. L. Bridewell, New Albany, Indiana.

Claim—1st, The employment, in connexion with a single frame piece of the box, which is cast in the manner specified, with axle, journal bearings, and flanches, in one piece, for the purpose of connecting and securing all the gearing necessary for the operation of the machine. 2d, The spring, secured at one end

to the front of the outer guard, and playing freely in the opening of the rear of said guard, in combination with the adjusting screw, whereby the convexity of the spring shoe is increased and diminished with the elevation or depression of the cutter.

131. METHOD OF ENABLING MOVING RAILROAD TRAINS TO TELEGRAPH THEIR OWN PASSINGS AT CERTAIN STATIONS; Ernest Otto Pohl, Philadelphia, Pennsylvania.

Claim—The use of a self-acting electro-magnetic railway alarm telegraph, acting reliably of itself without the necessity of human intervention, and arranged and operating in the manner described.

132. PRINTING PRESSES; F. O. Degener, City of New York; ante-dated July 11, 1858.

Claim—Arranging or hanging an oscillating bed with an oscillating platen, in such manner that the motion of one will control the action of the other, so that by their forward movement they shall close and give an impression, and upon their reverse movement the form shall be inked, and the platen be brought into the proper position necessary for the reception of the sheet, and thus alternate from one of their positions to the other. Also, the arrangement of an oscillating bed and platen with the cam to cause the frisket to assume the desired position, so as to hold the sheet of paper while it is being conveyed from one position to the other.

133. NURSERY BOTTLES; W. B. Potter, Boston, Massachusetts.

Claim—A nursing bottle of glass, having a metallic cap screwed upon it, and a metallic lacteal tube, when said cap is provided with a flanch for the reception of the elastic nipple.

134. GRINDING MILLS; Alfred Proseus, Philadelphia, Pennsylvania.

Claim—Placing across the recesses formed by the teeth of the shells, or of those of the burrs, or of both, of conical grinding mills, any convenient number of obstructing strips.

135. MACHINE FOR DRESSING HOOPS; Augustus Prenatt, Buffalo, New York.

Claim—Placing the cutters in the cutter head in such position that the plane of their cutting edge will cross their axis of motion at an angle of 45° (or nearly so), and also stand inclined to the horizontal plane of their axis at an angle of 45° (or nearly so). Also, the arrangement of the cutter in the vertically moving grate, including the adjustable roller, for the purpose of dressing the edge of the hoop, and for giving the hoop any required width, as described.

MECHANICS, PHYSICS, AND CHEMISTRY.

*Science as a Branch of Education.** By PROFESSOR FARADAY, D.C.L., F.R.S.

[Abstract of a Lecture before the Royal Institution of Great Britain.]

The development of the applications of physical science in modern times has become so large and so essential to the well-being of man, that it may justly be used as illustrating the true character of pure science, as a department of knowledge, and the claims it may have for consideration by governments, universities, and all bodies to whom is confided the fostering care and direction of learning. As a branch of learning, men are beginning to recognise the claim of science to its own particular place; for, though flowing in channels utterly different in their course and end to those of literature, it conduces not less, as a means of instruction, to the discipline of the mind; whilst it ministers, more or less, to the wants, comforts, and proper pleasure, both mental and bodily, of every individual of every class in life. Until of late years, the education for, and recognition of, it by the bodies which may be considered as giving the general course of all education, have been chiefly directed to it only as it could serve professional services, —namely, those which are remunerated by society; but now the fitness of university degrees in science is under consideration, and many are taking a high view of it, as distinguished from literature, and think that it may be well studied for its own sake, *i. e.*, as a proper exercise of the human intelligence, able to bring into action and development all the powers of the mind. As a branch of learning, it has (without reference to its applications,) become as extensive and varied as literature; and it has this privilege, that it must ever go on increasing.

* From the London Mechanics' Magazine, July, 1858.

Thus it becomes a duty to foster, direct, and honor it, as literature is so guided and recognised; and the duty is the more imperative, as we find by the unguided progress of science and the experience it supplies, that, of those men who devote themselves to studious education, there are as many whose minds are constitutionally disposed to the studies supplied by it, as there are of others more fitted by inclination and power to pursue literature.

The value of the public recognition of science as a leading branch of education may be estimated in a very considerable degree by observation of the results of the education which it has obtained incidentally from those who, pursuing it, have educated themselves. Though men may be specially fitted by the nature of their minds for the attainment and advance of literature, science, or the fine arts, all these men, and all others, require first to be educated in that which is known in these respective mental paths; and, when they go beyond this preliminary teaching, they require a self-education directed (at least in science) to the highest reasoning power of the mind. Any part of pure science may be selected to show how much this private self-teaching has done, and by that to aid the present movement in favor of the recognition generally of scientific education in an equal degree with that which is literary, but perhaps electricity, as being the portion which has been left most to its own development, and has produced as its results the most enduring marks on the face of the globe, may be referred to. In 1800, Volta discovered the voltaic pile; giving a source and form of electricity before unknown. It was not an accident, but resulted from his own mental self-education: it was, at first, a feeble instrument, giving feeble results; but by the united mental exertions of other men, who educated themselves through the force of thought and experiment, it has been raised up to such a degree of power as to give us light, and heat, and magnetic and chemical action, in states more exalted than those supplied by any other means.

In 1819, Oersted discovered the magnetism of the electric current, and its relation to the magnetic needle; and, as an immediate consequence, other men, as Arago and Davy, instructing themselves by the partial laws and action of the bodies concerned, magnetized iron by the current. The results were so feeble at first as to be scarcely visible; but, by the exertion of self-taught men since then, they have been exalted so highly as to give us magnets of a force unimaginable in former times.

In 1831, the induction of electrical currents one by another, and the evolution of electricity from magnets, was observed,—at first in results so small and feeble that it required one much instructed in the pursuit to perceive and lay hold of them; but these feeble results, taken into the minds of men already partially educated and ever proceeding onwards in their self-education, have been so developed as to supply sources of electricity independent of the voltaic battery or the electric machine, yet having the power of both combined in a manner and degree which they neither separate nor together could ever have given it, and applicable to all the practical electrical purposes of life.

To consider all the departments of electricity fully, would be to lose the argument for its fitness in subserving education in the vastness of its extent; and it will be better to confine the attention to one application, as the electric telegraph, and even to one small part of that application, in the present case. Thoughts of an electric telegraph came over the minds of those who had been instructed in the nature of electricity, as soon as the conduction of that power with extreme swiftness through metals was known, and grew as the knowledge of that branch of science increased. The thought, as realized at the present day, includes a wonderful amount of study and development. As the end in view presented itself more and more distinctly, points at first apparently of no consequence to the knowledge of the science generally, rose into an importance which obtained for them the most careful culture and examination, and the almost exclusive exercise of minds whose powers of judgment and reasoning had been raised first by general education, and who, in addition, had acquired the special kind of education which the science in its previous state could give. Numerous and important as the points are which have been already recognised, others are continually coming into sight as the great development proceeds, and with a rapidity such as to make us believe that, much as there is known to us, the unknown far exceeds it, and that, extensive as is the teaching of method, facts, and law, which can be established at present, an education looking for far greater results should be favored and preserved.

The results already obtained are so large, as even in money value to be of very great importance;—as regards their higher influence upon the human mind, especially when that is considered in respect of cultivation, I trust they are, and ever will be, far greater. No intention exists here of comparing one telegraph with another, or of assigning their respective dates, merits, or special uses. Those of Mr. Wheatstone are selected for the visible illustration of a brief argument in favor of a large public recognition of scientific education, because he is a man both of science and practice, and was one of the very earliest in the field, and because certain large steps in the course of his telegraphic life will tell upon the general argument. Without referring to what he had done previously, it may be observed that in 1840 he took out patents for electric telegraphs which included, amongst other things, the use of the electricity from magnets at the communicator, —the dial face,—the step-by-step motion,—and the electro-magnet at the indicator. At the present time, 1858, he has taken out patents for instruments containing all these points; but these instruments are so altered and varied in character above the former, that an untaught person could not recognise them. The changes may be considered as the result of education upon the one mind which has been concerned with them, and are to me strong illustrations of the effects which general scientific education may be expected to produce.

In the first instruments powerful magnets were used, and keepers with heavy coils associated with them. When magnetic electricity was first discovered, the signs were feeble, and the mind of the student was

led to increase the results by increasing the force and size of the instruments. When the object was to obtain a current sufficient to give signals through long circuits, large apparatus were employed, but these involved the inconveniences of inertia and momentum; the keeper was not set in motion at once, nor instantly stopped; and, if connected directly with the reading indexes, these circumstances caused an occasional uncertainty of action. Prepared by its previous education, the mind could perceive the disadvantages of these influences, and could proceed to their removal; and now a small magnet is used to send sufficient currents through 12, 20, 50, a hundred, or several hundred miles; a keeper and helix is associated with it, which the hand can easily put in motion; and the currents are not sent out of the indicating instrument to tell their story until a key is depressed, and thus irregularity contingent upon first action is removed. A small magnet, ever ready for action and never wasting, can replace the voltaic battery; if powerful agencies be required, the electro-magnet can be employed without any change in principle or telegraphic practice; and, as magneto-electric currents have special advantages over voltaic currents, these are in every case retained. These advantages I consider as the results of scientific education, much of it not tutorial, but of self; but there is a special privilege about the science-branch of education, namely, that what is personal in the first instance immediately becomes an addition to the stock of scientific learning, and passes into the hands of the tutor, to be used by him in the education of others, and enable them in turn to educate themselves. How well may the young man entering upon his studies in electricity be taught by what is past to watch for the smallest signs of action, new or old; to nurse them up by any means until they have gained strength; then to study their laws, to eliminate the essential conditions from the non-essential, and at last to refine again, until the encumbering matter is as much as possible dismissed, and the power left in its highly developed and most exalted state.

The alterations or successions of currents produced by the movement of the keeper at the communicator pass along the wire to the indicator at a distance; there each one for itself confers a magnetic condition on a piece of soft iron, and renders it active or repulsive of small permanent magnets; and these, acting in turn on a propelment, cause the index to pass at will from one letter to another on the dial face. The first electro-magnets, *i. e.*, those made by the circulation of an electric current round a piece of soft iron, were weak; they were quickly strengthened, and it was only when they were strong that their laws and actions could be successfully investigated. But now they were required small, yet potential. Then came the teaching of Ohm's law; and it was only by patient study under such teaching that Wheatstone was able so to refine the little electro-magnets at the indicator, as that they should be small enough to consist with the fine work there employed, able to do their appointed work when excited in contrary directions by the brief currents flowing from the original common magnet, and unobjectionable in respect of any resistance they might offer to the transit of these tell-tale currents.

These small transitory electro-magnets attract and repel certain permanent magnetic needles, and the to-and-fro motion of the latter is communicated by a propelment to the index, being there converted into a step-by-step motion. Here everything is of the finest workmanship, the propelment itself requires to be watched by a lens, if its action is to be observed; the parts never leave hold of each other; the vibratory or rotary ratchet wheel and the fixed pallets are always touching; and thus allow of no detachment or loose shake; the holes of the axes are jeweled; the moving parts are most carefully balanced, a consequence of which is that agitation of the whole does not disturb the parts, and the telegraph works just as well when it is twisted about in the hands, or placed on board a ship or in a railway carriage, as when fixed immovably. When it is possible, as in the vibratory needle, the moving parts are brought near to the centre of motion, that the inertia of the portion to be moved, or the momentum of that to be stopped, should be as small as possible, and thus great quickness of indication obtained. All this delicacy of arrangement and workmanship is introduced advisedly; for the inventor, whom I may call the student here, considers that refined and perfect workmanship is more exact in its action, more unchangeable by time and use, and more enduring in its existence, than that which, being heavier, must be coarser in its workmanship, less regular in its action, and less fitted for the application of force by fine electric currents.

Now there was no accident in the course of these developments;—if there were experiments, they were directed by the previously acquired knowledge;—every part of the investigations was made and guided by the instructed mind. The results being such (and like illustrations might be drawn from other men's telegraphs, or from other departments of electrical science), then, if the term education may be understood in so large a sense as to include all that belongs to the improvement of the mind, either by the acquisition of the knowledge of others or by increase of it through its own exertions, we learn by them what is the kind of education science offers to man. It teaches us to be *neglectful* of nothing;—not to despise the small beginnings, for they precede of necessity all great things in the knowledge of science, either pure or applied. It teaches a continual comparison of the *small and great*, and that under differences almost approaching the infinite: for the small as often contains the great in principle as the great does the small; and thus the mind becomes comprehensive. It teaches to deduce principles carefully, to hold them firmly, or to suspend the judgment:—to discover and obey *law*, and by it to be bold in applying to the greatest what we know of the smallest. It teaches us first by tutors and books to learn that which is already known to others, and then by the light and methods which belong to science to learn for ourselves and for others;—so making a fruitful return to man in the future for that which we have obtained from the men of the past. Bacon, in his instruction, tells us that the scientific student ought not to be as the ant, who gathers merely; nor as the spider, who spins from her own bowels; but rather as the bee, who both gathers and produces.

All this is true of the teaching afforded by any part of physical science. Electricity is often called wonderful, beautiful; but it is so only in common with the other forces of nature. The beauty of electricity, or of any other force, is not that the power is mysterious and unexpected, touching every sense at unawares in turn, but that it is under *law*, and that the taught intellect can even now govern it largely. The human mind is placed above, not beneath it; and it is in such a point of view that the mental education afforded by science is rendered supereminent in dignity, in practical application, and utility; for, by enabling the mind to apply the natural power through law, it conveys the gifts of God to man.

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*Units of Work.**

The following are the results obtained in units of work or foot-pounds for one unit of heat by different authors.

	Centigrade thermometer. Foot-pounds.	Fahrenheit thermometer. Foot-pounds.
By Holtzman's formula,	1227	682
By Joule's experiments,	1386	770
By Rankine's formula,	1252	695
By Thompson's formula,	1390	772
For the best Cornish engine, by M. De Pambour,	148	82
For a perfect low-pressure condensing engine,	90·8	50·4
For an actual Boulton and Watt's engine,	46	25·5

Ransome's Process for Preserving Stone.† By R. Hunt.

The importance of the discovery of a process, which could be relied on, for the preservation of the stones employed in the erection of our public and other buildings, has long been felt; and many experiments have been made in the hope of attaining this object. In London, and in several of the large towns in the Provinces, we could point to buildings which have within a very few years exhibited the most unmistakable signs of decay. Lamina after lamina falls off, exposing a new surface to be freshly acted upon by the destroying agents; and thus, with comparative rapidity, the work of decay progresses; this has been referred to atmospheric causes, existing *now* as the result of our extensive manufactories and greatly increased population; but, to whatever cause the disintegration of the stone may be traced, certain it is, that scarcely any modern building, whether constructed of the coal measure sandstones, dolomites, oolites, or other well-known building stones, but exhibits, in a few years after its completion, lamentable evidences of decay.

Our attention has been directed to the Baptist Chapel built by Sir Morton Peto, in Bloomsbury. For some time past the Caen stone used in this structure has been crumbling, especially where it was exposed

* From the London Civ. Eng. and Arch. Jour., September, 1858.

† From the London Art Journal, October, 1858.

to the action of water. The disintegration was proceeding so rapidly that it became necessary to give immediate attention to it. It was determined that Mr. Frederick Ransome should make an experiment upon the towers, where the stone was in a worse condition than in any other part. The result of this experiment was so satisfactory that it was resolved that the entire building should be subjected to this process.

The most enduring stones in nature are those in which the cementing agent is *silica*—and it became a problem with the patentee, to produce a true *siliceous surface* upon any stones which appeared naturally liable to decay. All the sandstones are more or less porous, consequently they absorb water readily—this is one cause of their rapid disintegration. Availing himself of this, Mr. Ransome produces the desired result. First, the stone is made to absorb as much of a solution of the silicate of soda as possible; this being effected, it is washed with chloride of calcium. The play of chemical affinity is now brought into action *in the stone:* a double decomposition is effected, and insoluble silicate of lime fills the interstices; chloride of sodium (common salt) being formed, which is readily removed. It will be evident to all, that since every particle of the stone, to the depth penetrated by the solution, is surrounded by this silicate of soda, and that too—according to the law of surface action—in a concentrated form, that the silicate of lime which results from the action of the chloride on it, must completely fill the interstitial spaces, and thus render a stone, which was previously absorbent, absolutely non-absorbent.—(*Vide Art Journal*, Sept., 1857.

It will be found, that the stone surface of the Rev. W. Brock's chapel is now actually repellent of water, and that the hardness of the surface indicates a complete casing of the preservative silica. It should be distinctly understood that this process will not merely protect new stone from the influences of atmospheric action, but it stops decay in stones already exfoliating, and preserves them from future action.

Stones which have been in a state of rapid decomposition have been, for experiment, partially treated by this silicifying process. The result has been that the prepared parts have withstood the action of air, rain, and frost, showing no signs of injury, while the unprepared parts have completely broken up.

Beyond this, its preservative power, another advantage of the process is, that it can be applied to any stone without in the slightest degree affecting its color or grain: all the natural conditions are preserved, and the hardening superinduced.

Now that a well-known public building has been treated by this process, the result can be observed by every one. The *rationale* of the process alone—independently of the experiments which have been made—satisfies us that there is little chance of disintegration ensuing after the proper application of the solutions. We hope to watch the influences of heat and cold upon the surface of the Bloomsbury Baptist Chapel, and we will faithfully report the results of our examination to the readers of the *Art Journal.*

*Improvements in the Art of Engraving.** Patented in London, by WILLIAM HENRY FOX TALBOT, April 21, 1858.

In this invention I employ plates of steel, copper, or zinc, such as are commonly used by engravers. Before using a plate, its surface should be well cleaned. It should then be rubbed with a linen cloth dipped in a mixture of caustic soda, and whiting, in order to remove any remaining trace of greasiness. The plate is then to be rubbed dry with another linen cloth; this process is then to be repeated, after which the plate is, in general, sufficiently clean.

In order to engrave a plate I first cover it with a substance which is sensitive to light. This is prepared as follows:—About a quarter of an ounce of gelatine is dissolved in eight or ten ounces of water, by the aid of heat. To this solution is added about one ounce by measure, of a saturated solution of bichromate of potash in water, and the mixture is strained through a linen cloth. The best sort of gelatine for the purpose is that used by cooks and confectioners, and commonly sold under the name of gelatine. In default of this, isinglass may be used, but it does not answer so well. Some specimens of isinglass have an acidity which slightly corrodes and injures the metal plates. If this accident occurs, ammonia should be added to the mixture, which will be found to correct it. This mixture of gelatine and bichromate of potash keeps good for several months, owing to the antiseptic and preserving power of the bichromate. It remains liquid and ready for use at any time during the summer months, but in cold weather it becomes a jelly, and has to be warmed before using it. It should be kept in a cupboard or dark place. The proportions given above are convenient, but they may be considerably varied without injuring the result. The engraving process should be carried on in a partially darkened room, and is performed as follows:—

A little of this prepared gelatine is poured on the plate to be engraved, which is then held vertical, and the superfluous liquid allowed to drain off at one of the corners of the plate; it is then held in a horizontal position over a spirit lamp, which soon dries the gelatine, which is left as a thin film of a pale yellow color covering the metallic surface, and generally bordered with several narrow bands of prismatic colors. These colors are of use to the operator, by enabling him to judge of the thinness of the film. When it is very thin the prismatic colors are seen over the whole surface of the plate. Such plates often make excellent engravings; nevertheless, it is perhaps safer to use gelatine films which are a little thicker. Experience alone can guide the operator to the best result. The object to be engraved is then laid on the metal plate and screwed down upon it in a photographic copying frame. Such objects may be either material substances, as lace, the leaves of plants, &c., or they may be engravings, or writings, or photographs, &c., &c.

* From the Repertory of Patent Inventions, Nov. 1858.

The plate bearing the object upon it is then to be placed in the sunshine for a space of time, varying from one to several minutes, according to circumstances. Or else it may be placed in common daylight, but of course for a longer time. As in other photographic processes, the judgment of the operator is here called into play, and his experience guides him as to the proper time of exposure to the light. When the frame is withdrawn from the light, and the object removed from the plate, a faint image is seen upon it, the yellow color of the gelatine having turned brown wherever the light has acted. This process, so far as I have yet described it, is in all essential respects identical with that which I described in the specification of my former patent for improvements in engraving, bearing date the 29th of October, 1852.

The novelty of the present invention consists in the improved method by which the photographic image obtained in the manner above described is engraved upon the metal plate. The first of these improvements is as follows:—I formerly supposed that it was necessary to wash the plate bearing the photographic image in water, or in a mixture of water and alcohol, which dissolves only those portions of the gelatine on which the light has not acted. And I believe that all other persons who have employed this method of engraving by means of gelatine and bichromate of potash have followed the same method, viz: that of washing the photographic image. But, however carefully this process is conducted, it is frequently found when the plate is again dry that a slight disturbance of the image has occurred, which of course is injurious to the beauty of the result. And I have now ascertained that it is not at all necessary to wash the photographic image. On the contrary, much more beautiful engravings are obtained upon plates which have not been washed, because the more delicate lines and details of the picture have not been disturbed. The process which I now employ is as follows:—When the plate bearing the photographic image is removed from the copying frame, I spread over its surface carefully and very evenly a little finely-powdered gum copal (in default of which common resin may be employed). It is much easier to spread this resinous powder evenly upon the surface of the gelatine than it is to do so upon the naked surface of a metal plate. The chief error the operator has to guard against is that of putting on too much of the powder; the best results are obtained by using a very thin layer of it, provided it is uniformly distributed. If too much of the powder is laid on, it impedes the action of the etching liquid. When the plate has been thus very thinly powdered with copal it is held horizontally over a spirit lamp in order to melt the copal. This requires a considerable heat. It might be supposed that this heating of the plate, after the formation of a delicate photographic image upon it, would disturb and injure that image, but it has no such effect. The melting of the copal is known by its change of color. The plate should then be withdrawn from the lamp and suffered to cool. This process may be called the laying on aquatint ground upon the gelatine, and I believe it to be a new process. In the common mode of laying on an aquatint ground, the resinous particles are laid upon the naked surface of the metal before the en-

graving is commenced. The gelatine being thus covered with a layer of copal disseminated uniformly and in minute particles, the etching liquid is to be poured on. This is prepared as follows:—Muriatic acid, otherwise called hydrochloric acid, is saturated with peroxide of iron, as much as it will dissolve with the aid of heat. After straining the solution to remove impurities, it is evaporated till it is considerably reduced in volume, and is then poured off into bottles of a convenient capacity. As it cools it solidifies into a brown semi-crystalline mass. The bottles are then well corked up and kept for use.

I shall call this preparation of iron by the name of per-chloride of iron in the present specification, as I believe it to be identical with the substance described by chemical authors under that name. For example, see "Turner's Chemistry," 5th edition, page 537; and by others called permuriate of iron. For example, see "Brande's Manual of Chemistry," 2d edition, vol. ii, page 117.

It is a substance very attractive of moisture. When a little of it is taken from a bottle in the form of a dry powder and laid upon a plate it quickly deliquesces, absorbing the atmospheric moisture. In solution in water it forms a yellow liquid in small thicknesses, but chesnut-brown in greater thicknesses. In order to render its mode of action in photographic engraving more intelligible, I will first state that it can be very usefully employed in common etching; that is to say, that if a plate of copper, steel, or zinc is covered with an etching ground and lines are traced on it with a needle's point, so as to form any artistic subject, then, if the solution of perchloride of iron is poured upon the plate it quickly effects an etching, and does this without disengaging bubbles of gas, or causing any smell, for which reason it is much more convenient to use than aquafortis, and also because it does not injure the operator's hands or his clothes, if spilt upon them.

It may be employed of various strengths for common etching, but requires peculiar management for photoglyphic engraving. And as the success of that mode of engraving chiefly turns upon this point, it should be well attended to.

Water dissolves an extraordinary quantity of perchloride of iron, sometimes evolving much heat during the solution. I find that the following is a convenient way of proceeding:—A bottle, No. 1, is filled with a saturated solution of perchloride of iron in water.

A bottle, No. 2, with a mixture consisting of five or six parts of the saturated solution, and one part of water.

And a bottle, No. 3, with a weaker liquid, consisting of equal parts of water and of the saturated solution. Before attempting an engraving of importance it is almost essential to make preliminary trials, in order to ascertain that these liquids are of the proper strengths. These trials I shall therefore now proceed to point out. I have already explained how the photographic image is made on the surface of the gelatine and covered with a thin layer of powdered copal or resin, which is then melted by holding the plate over a lamp. When the plate has become perfectly cold it is ready for the etching process, which is performed as follows:—A small quantity of the solution in bottle No. 2, namely,

that consisting of five or six parts saturated solution to one of water, is poured upon the plate and spread with a camel-hair brush evenly all over it. It is not necessary to make a wall of wax round the plate, because the quantity of liquid employed is so small, that it has no tendency to run off the plate. The liquid penetrates the gelatine wherever the light has not acted on it, but it refuses to penetrate those parts upon which the light has sufficiently acted. It is upon this remarkable fact that the art of photoglyphic engraving is mainly founded. In about a minute the etching is seen to begin, which is known by the parts etched turning dark-brown or black, and then it spreads over the whole plate, the details of the picture appearing with great rapidity in every quarter of it. It is not desirable that this rapidity should be too great, for in that case it is necessary to stop the process before the etching has acquired sufficient depth (which requires an action of some minutes duration). If, therefore, the etching on trial is found to proceed too rapidly, the strength of the liquid in bottle No. 2 must be altered (by adding some of the saturated solution to it) before it is employed for another engraving. But if, on the contrary, the etching fails to occur after the lapse of some minutes, or if it begins, but proceeds too slowly, this is a sign that the liquid in bottle No. 2 is too strong, and too nearly approaching saturation. To correct this, a little water must be added to it before it is employed for another engraving. But in doing this the operator must take notice that a very minute quantity of water, added often, makes a great difference and causes the liquid to etch very rapidly. He will, therefore, be careful in adding water not to do so too freely. When the proper strength of the solution in bottle No. 2 has just been adjusted, which generally requires three or four experimental trials, it can be employed with security. Supposing, then, that it has been ascertained to be of the right strength, the etching is commenced as above mentioned, and proceeds till all the details of the picture have become visible, and present a satisfactory appearance to the eye of the operator, which generally occurs in two or three minutes; the operator stirring the liquid all the time with a camel-hair brush, and thus slightly rubbing the surface of the gelatine, which has a good effect. When it seems likely that the etching will improve no farther, it must be stopped. This is done by wiping off the liquid with cotton wool, and then rapidly pouring a stream of cold water over the plate, which carries off all the remainder of it. The plate is then wiped with a clean linen cloth, and then rubbed with soft whiting and water to remove the gelatine. The etching is then found to be completed.

I will now describe another etching process very slightly differing from the former, which I often use. When the plate is ready for etching, pour upon it a small quantity of the liquid No. 1 (the saturated solution). This should be allowed to rest upon the plate one or two minutes. It has no very apparent effect, but it acts usefully in hardening the gelatine. It is then poured off from the plate, and a sufficient quantity of solution No. 2 is poured on. This effects the etching in the manner before described; and if this appears to be quite satisfactory,

nothing further is required to be done. But it often happens that certain faint portions of the engraving, such as distant mountains or buildings in a landscape, refuse to appear, and as the engraving would be imperfect without them I recommend the operator in that case to take some of the weak liquid No. 3 in a little saucer, and without pouring off the liquid No. 2, which is etching the picture, to touch with a camel-hair brush, dipped in liquid No. 3, those points of the picture where he wishes for an increased effect. This simple process often causes the wished-for details to appear, and that sometimes with great rapidity, so that caution is required in the operator in using this weak solution, No. 3, especially lest the etching liquid should penetrate to the parts which ought to remain white. But in skilful hands, its employment cannot fail to be advantageous, for it brings out soft and faint shadings, which improve the engraving, and which would otherwise probably be lost. Experience is requisite in this as in most other delicate operations connected with photography; but I have endeavored clearly to explain the leading principles of this new process of engraving according to the mode which I have hitherto found the most successful.

With respect to the second invention mentioned in my provisional specification, in which the electrotype process is employed, I have found that it gives less successful results than that which I have fully described above, and I have therefore omitted it from this specification, and make no claim with respect to it.

In conclusion I would remark, that besides the process of photographic engraving considered as a whole being new, I believe the following points also to be new, viz:—

First, the etching a photographic image formed upon a surface of gelatine and bichromate of potash, without first disturbing that surface by washing it with water or alcohol.

Second, the laying an aquatint ground of resin or copal upon a surface of gelatine, and not, as usual, upon the naked metallic surface of the plate.

Third, after forming a photographic image on gelatine, the heating it strongly over a spirit-lamp or otherwise.

Fourth, the use and employment of perchloride of iron as an etching liquid for the production of photographic engravings.

Fifth, the use and employment of the same as a substitute for aquafortis in common etching.

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*Chemical Matches without Phosphorus or other Poison.**

By M. CANOUIL.

The new matches are absolutely without white or red phosphorus, ordinary or amorphous. They cannot be used as a poison, and when reduced to their least degree of inflammability give rise to no danger of fire. They are formed essentially of chlorate of potash, mixed with

* From the London Chemical Gazette, No. 388.

when it is desired to render them more inflammable. The author has found means to triturate the chlorate of potash, even when dry, without danger of explosion.

The new matches diffuse no odor, either in the manufacture or in use; they light without explosion or projection.—*Comptes Rendus*, June 28, 1858, p. 1268.

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*On the Hardness of Metals and Alloys.** By F. CRACE CALVERT, M.R.A., of Turin, F.C.S., &c.; and RICHARD JOHNSON, F.C.S., &c.

[Read before the Literary and Philosophical Society of Manchester.]

The process at present adopted for determining the comparative degree of hardness of bodies, consists in rubbing one body against another, and that which indents or scratches the other is admitted to be the harder of the two bodies experimented upon. Thus, for example:

Diamond,	Quartz,	Iron,	Tin,
Topaz,	Steel,	Copper,	Lead.

This method is not only very unsatisfactory in its results, but it is also inapplicable for determining with precision the various degrees of hardness of the different metals and their alloys. We therefore thought that it would be useful and interesting if we were to adopt a process which would enable us to represent by numbers the comparative degrees of hardness of various metals and their alloys.

To carry out these views we devised the following apparatus and method of operating. The machine used is on the principle of a lever, with this important modification, that the piece of metal experimented upon can be relieved from the pressure of the weight employed without removing the weight from the end of the longer arm of the lever. The machine consists of a lever, with a counterpoise and a plate, on which the weights are gradually placed; the fulcrum bears on a square bar of iron, passing through supports. The bar is graduated, and has at its end a conical steel point, 7 *mm.* or 0·275 of an inch long, 5 *mm.* or 0·197 of an inch wide at the base, and 1·25 *mm.* or 0·049 of an inch wide at the point which bears on the piece of metal to be experimented on, and this is supported on a solid piece of iron. The support, or point of resistance, is lowered or raised by a screw, and when, therefore, this screw is turned, the whole of the weight on the lever is borne by the support and the screw. When it is necessary, by turning the screw, the weight on the lever is re-established on the bar, and experimented upon.

When we wished to determine the degree of hardness of a substance, we placed it on the plate, and rested the point upon it, noticing the exact mark on the bar, and then gradually added weights on the end of the lever until the steel point entered 3·5 *mm.* or 0·128 of an inch during half an hour, and then read off the weight. A result was never accepted without at least two experiments being made, which corresponded so far as to present a difference of only a few pounds. The

* From the Journal of the Society of Arts, No 314.

following table gives the relative degree of hardness of some of the more common metals. We specially confine our researches to this class, wishing the results to be practically useful to engineers and others who have to employ metals, and often require to know the comparative hardness of metals and alloys.

Names of Metals.	Weight employed.	Calculated Cast Iron = 1000.
Staffordshire Cold Blast Cast Iron —Grey, No. 3,	4800 lbs.	1000
Steel,	4600?	958?
Wrought Iron,*	4550	948
Platinum,	1800	375
Copper—pure,	1445	301
Aluminium,	1300	271
Silver—pure,	1000	208
Zinc "	880	183
Gold "	800	167
Cadmium"	520	108
Bismuth "	250	52
Tin "	130	27
Lead "	75	16

* This wrought iron was made from the above mentioned cast iron.

This table exhibits a curious fact, viz: the high degree of hardness of cast iron as compared with that of all other metals, and although we found alloys which possessed an extraordinary degree of hardness, still none were equal to cast iron.

The first series of alloys we shall give, is that of copper and zinc.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated* Cast Iron = 1000.
$Zn\ Cu_5$ { Cu 82·95 / Zn 17·05 }	2050 lbs.	427·08	280·83
$Zn\ Cu_4$ { Cu 79·56 / Zn 20·44 }	2250	468·75	276·82
$Zn\ Cu_3$ { Cu 74·48 / Zn 25·52 }	2250	468·75	276·04
$Zn\ Cu_2$ { Cu 66 06 / Zn 33·94 }	2270	472·92	261·04
$Zn\ Cu$ { Cu 49·32 / Zn 50·68 }	2900	604·17	243·33
$Cu\ Zn_2$ { Cu 32·74 / Zn 67·26 }	Broke with 1500 lbs. without the point entering.		
$Cu\ Zn_3$ { Cu 24·64 / Zn 75·36 }	Broke with 1500 lbs. with an impression ½ *mm.* deep.		
$Cu\ Zn_4$ { Cu 19·57 / Zn 80·43 }	Entered a little more than the above; broke with 2000 lbs.		
$Cu\ Zn_5$ { Cu 16·30 / Zn 83·70 }	Entered 2 *mm.* with 1500 lbs.; broke with 1700 lbs.		

* To calculate the hardness of an alloy, we multiplied the per centage quantity of each metal by the respective hardness of that metal, added the two results together, and divided by 100. The quotient is the theoretical hardness.

These results show that all the alloys containing an excess of copper are much harder than the metals composing them, and, what is

not less interesting, that the increased degree of hardness is due to the zinc, the softer metal of the two which compose these alloys. The quantity of this metal must, however, not exceed 50 ℔ cent. of the alloy, or the alloy becomes so brittle that it breaks as the steel point penetrates. We believe that some of these alloys, with an excess of zinc, and which are not found in commerce owing to their white appearance, deserve the attention of engineers. There is in this series an alloy to which we wish to draw special attention, viz: the alloy Cu Zn, composed in 100 parts of

Copper, . .	49·32
Zinc, . .	50·68
	100·00

Although this alloy contains about 20 ℔ cent. more zinc than any of the brasses of commerce, still it is, when carefully prepared, far richer in color than the ordinary alloys of commerce. The only reason that we can give why it has not been introduced into the market is, that when the amount of zinc employed exceeds 33 ℔ cent., the brass produced becomes so white that the manufacturers have deemed it advisable not to exceed that proportion. If, however, they had increased the quantity to exactly 50·68 ℔ cent., and mixed the metals well, they would have obtained an alloy as rich in color as if it had contained 90 ℔ cent. of copper, and of a hardness three times as great as that given by calculation. In order to enable engineers to form an opinion as to the value of this cheap alloy, we give them the degrees of hardness of several commercial brasses:—

Commercial Brasses.		Weight employed.	Cast Iron = 1000.	
			Obtained.	Calculated.
"Large Bearing,"	Copper, 82·05 *Tin, 12·82 Zinc, 5·13	lbs. 2700	562	259
"Mud Plugs,"	Copper, 80·00 *Tin, 10·00 Zinc, 10·00	3600	750	262
"Yellow Brass,"	Copper, 64·00 Zinc, 36·00	2500	520	258
"Pumps & Pipes,"	Copper, 80·00 *Tin, 5·00 Zinc, 7·50 Lead, 7·50	1650	343	257

*These alloys all contain tin.

The alloy Cu Zn possesses another remarkable property, viz: the facility with which it is capable of cystallizing in prisms half an inch in length, of extreme flexibility. There is no doubt that this alloy is a definite chemical compound, and not a mixture of metals, as alloys are generally considered to be. Our researches on the conductibility of heat by alloys, recently presented to the Royal Society, leave no doubt that many alloys are definite chemical compounds.

On Bronze Alloys.

Formulæ of Alloys and percentages.	Weight employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
$Cu\ Sn_5$ { Cu 9·73 / Sn 90·27 }	400 lbs.	88·33	51·67
$Cu\ Sn_4$ { Cu 11·86 / Sn 88·14 }	460	95·81	59·56
$Cu\ Sn_3$ { Cu 15·21 / Sn 84·79 }	500	104·17	68·75
$Cu\ Sn_2$ { Cu 21·21 / Sn 78·79 }	650	135·42	84·79
Cu Sn { Cu 34·98 / Sn 65·02 }	At 700 lbs. the point entered one-half and the alloy broke.		
$Sn\ Cu_2$ { Cu 48·17 / Sn 51·83 }	At 800 lbs. the alloy broke without the point entering.		
$Sn\ Cu_3$ { Cu 61·79 / Sn 38·21 }	At 800 lbs. the alloy broke in small pieces (blue alloy).		
$Sn\ Cu_4$ { Cu 68·27 / Sn 31·73 }	At 1300 lbs. divided the alloy in two, point not entering 1 *mm.*		
$Sn\ Cu_5$ { Cu 72·90 / Sn 27·10 }	The same as the preceding.		
$Sn\ Cu_{10}$ { Cu 84·32 / Sn 15·68 }	4400	916·66	257·08
$Sn\ Cu_{15}$ { Cu 88·97 / Sn 11·03 }	3710	772·92	270·83
$Sn\ Cu_{20}$ { Cu 91·49 / Sn 8·51 }	3070	639·58	277·70
$Sn\ Cu_{25}$ { Cu 93·17 / Sn 6·83 }	2890	602·08	279·16

The results obtained from this series of alloys lead to several conclusions deserving our notice. First, the marked softness of all the alloys containing an excess of tin; secondly, the extraordinary fact that an increased quantity of so malleable a metal as copper, should so suddenly render the alloy brittle, for the

Alloy $Cu\ Sn_2$, or

Copper, . . 21·21 }
Tin, . . . 78·79 } is not brittle.

whilst the alloy Cu Sn, or

Copper, . . 34·98 }
Tin, . . . 65·02 } is brittle.

Therefore the addition of 14 % cent. of copper renders a bronze alloy brittle. This curious fact is observed in all the alloys with excess of copper, $Sn\ Cu_2$, $Sn\ Cu_3$, $Sn\ Cu_4$, $Sn\ Cu_5$, until we arrive at one containing a great excess of copper, viz: the alloy $Sn\ Cu_{10}$, consisting of copper 84·68 and tin 15·32, when the brittleness ceases; but, strange to say, this alloy, which contains four-fifths of its weight of copper, is, notwithstanding, nearly as hard as iron. This remarkable influence of copper in the bronze alloys is also visible in those composed of

$Sn\ Cu_{15}$, containing 88·97 of copper.
$Sn\ Cu_{20}$, " 91·49 "
$Sn\ Cu_{25}$, " 93 17 "

Copper acquires such an increased degree of hardness by being alloyed

with tin or zinc, that we thought it interesting to ascertain if alloys composed of these two metals would also have a greater degree of hardness than that indicated by theory; we accordingly had a series of alloys prepared in equivalent quantities, and these are the results arrived at:—

Formulæ of Alloys and per centages of each.		Weight employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
$Zn\ Sn_2$	Zn 21·65, Sn 78·35	300 lbs.	64·50	60·83
$Zn\ Sn$	Zn 35·60, Sn 64·40	330	68·75	82·70
$Sn\ Zn_2$	Sn 47·49, Zn 52·51	400	83·33	110·00
$Sn\ Zn_3$	Sn 37·57, Zn 62·43	450	93·70	124·58
$Sn\ Zn_4$	Sn 31·14, Zn 68·86	505	105·20	131·22
$Sn\ Zn_5$	Sn 26·57, Zn 73·43	600	125·00	142·08
$Sn\ Zn_{10}$	Sn 15·32, Zn 84·68	580	120·33	158·33

These results show that these metals exert no action on each other, as the numbers indicating the degrees of hardness of their alloys are rather less than those required by theory. Our researches on the conductibility of heat by the three above series of alloys throw, we believe, some light on the great difference which the alloys of bronze present as compared with those of tin and zinc; for we have stated above that the latter conduct heat as a mixture of metals would do, and not as the former series, which conduct heat as definite chemical compounds.

We shall conclude by giving the degrees of hardness of two other series of alloys, viz: those composed of lead and antimony, and lead and tin. In the series of lead and tin we find that tin also increases the hardness of lead, but not in the same degree as it does that of copper.

Lead and Antimony.

Formulæ of Alloys and percentages.		Weight employed.	
$Pb\ Sb_5$	Pb 21·31, Sb 75·69	lbs.	Entered 2·5 *mm.* with 800 lbs.; then broke.
$Pb\ Sb_4$	Pb 28·64, Sb 71·36		Entered 2·7 *mm.* with 800 lbs.; broke with 900 lbs.
$Pb\ Sb_3$	Pb 34·86, Sb 65·14	875	
$Pb\ Sb_2$	Pb 44 53, Sb 55 47		Entered 2·5 *mm.* with 500 lbs.; broke with 600 lbs.
$Pb\ Sb$	Pb 61·61, Sb 38·39	500	
$Sb\ Pb_2$	Pb 76·32, Sb 23·68	385	
$Sb\ Pb_3$	Pb 82·80, Sb 17·20	310	
$Sb\ Pb_4$	Pb 86·52, Sb 13·48	300	
$Sb\ Pb_5$	Pb 88 92, Sb 11·08	295	

Lead and Tin.

Formulæ of Alloys and percentages.	Weight employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
$Pb\ Sn_5$ { Pb 26·03 / Sn 73·97 }	200 lbs.	41·67	23·96
$Pb\ Sn_4$ { Pb 30·57 / Sn 69·43 }	105	40·62	23·58
$Pb\ Sn_3$ { Pb 36·99 / Sn 63·01 }	160	32·33	22·83
$Pb\ Sn_2$ { Pb 46·82 / Sn 53·18 }	125	26·04	20·09
$Pb\ Sn$ { Pb 63·78 / Sn 36·22 }	100	20·83	19·77
$Sn\ Pb_2$ { Pb 77·89 / Sn 22·11 }	125	26·04	18·12
$Sn\ Pb_3$ { Pb 84·09 / Sn 15·91 }	135	28·12	17·23
$Sn\ Pb_4$ { Pb 87·57 / Sn 12·43 }	125	26·04	17·08
$Sn\ Pb_5$ { Pb 89·80 / Sn 10·20 }	110	22·92	16·77

We have great pleasure in thanking here, Mr. Siméon Stoikowitsch, F.C.S., for his valuable assistance during these long researches.

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*On a method of rendering Engraved Copperplates capable of producing a greatly-increased Number of Impressions.** By F. Joubert.

Under the circumstances which I have described, it had become a desideratum to harden, if possible, the surface of a copperplate, and to protect it from wear while printing, but it is only lately that this important object has been attained.

In March last, my friend, M. Jacquin, of Paris, took out a patent in this country for a method of coating plates with iron, which had already been successfully applied in France, and of which the merit is due to my friend, M. Henri Garnier, of Paris.

I have myself had the advantage of co-operating with M. Garnier in the development of the invention, the principles of which I shall now proceed to describe:—

If the two wires of a galvanic battery be plunged separately into a solution of iron, having ammonia for its basis, the wire of the positive pole is immediately acted upon, while that of the negative pole receives a deposit of the metal of the solution—this is the principle of the process which we have named "acierage."

The operation takes place in this way:—By placing at the positive pole a plate or sheet of iron, and immersing it in a proper iron solution, the metal will be dissolved under the action of the battery, and will form hydrochlorate of iron, which, being combined with the hydro-

* From the Journal of the Society of Arts, No. 314.

chlorate of ammonia of the solution, will become a bichloride of ammonia and iron; if a copper plate be placed at the opposite pole and likewise immersed, the solution being properly saturated, a deposit of iron, bright and perfectly smooth, is thrown upon the copperplate, from this principle:—

Water being composed of hydrogen and oxygen.

Sal ammoniac being composed of

1st. Hydrochloric acid containing chlorine and hydrogen.

2d. Ammonia, containing hydrogen, nitrogen, and oxygen.

The water is decomposed under the galvanic action, and the oxygen fixes itself on the iron plate, forming an oxide of iron; the hydrochloric acid of the solution acting upon this oxide forms a hydrochlorate of iron, whilst the hydrogen precipitates itself upon the plate of the negative pole, and, unable to combine with it, comes up to the surface of the solution in bubbles.

My invention has for its object certain means of preparing printing surfaces, whether for intaglio or surface printing, so as to give them the property of yielding a considerably greater number of impressions than they are capable of doing in their ordinary or natural state. And the invention consists in covering the printing surfaces, whether intaglio or relief, and whether of copper or other soft metal, with a very thin and uniform coating of iron, by means of electro-metallurgical processes. The invention is applicable whether the device to be printed from be produced by engraving by hand, or by machinery, or by chemical means, and whether the surface printed from be the original or an electrotype surface produced therefrom. I would remark that I am aware that it has been before proposed to coat type and stereotypes with a coating of copper, to enable their surfaces to print a larger number of impressions than they otherwise would do; I therefore lay no claim to the general application of a coating of harder metal on to the surface of a softer one, but my claim to invention is confined to the application of a coating of iron by means of electricity on to copper and other metallic printing surfaces.

In carrying out the invention the solutions of iron employed may be varied, and such is the case in respect to the arrangement of the galvanic battery or other source of the electric currents used; I do not therefore limit the invention to the means hereinafter described, but I believe they will be found to be the best for the purpose.

I would further remark that it is important that a ferric solution should be employed which will not dissolve or corrode the plate intended to be coated, for if it be attempted to use such a solution, though the iron will be precipitated, it will not only be in a non-coherent state, but the engraved surface itself will be liable to be attacked and injured. It may also be remarked that the coating of iron admits of being removed from a printing surface of copper without injury to the original plate, hence the original plate may, after being coated and used for some time, have the worn coating removed, and then be recovered with an iron coating as often as may be required; and if care is taken to remove the coating of iron before it has been entirely worn

away, the engraved copper or other plate may be made to print a vast number of impressions and yet remain in the original state it was in when it left the hands of the engraver, or was otherwise first produced; the only limit appears to be in the gradual change which takes place in the body of the printing surface by the compression to which it is subjected in the process of printing. Heretofore, in respect to plates engraved in intaglio, if of steel, they each yield on the average about 3000 impressions without re-touching; if of copper, they each yield on an average not more than 800 without re-touching; whilst electro casts of copper obtained from the originals will not on an average each yield even 200 impressions without re-touching; in fact such printing surfaces are so easily worn, that after the first 100 or 150 impressions, there is a considerable deterioration in the quality of the work produced. Therefore, for the supply of the number of impressions often required by art associations and others, it has been found necessary to multiply the electro casts very considerably. In such cases the invention is applicable with considerable advantage, for I find that an electro plate 40×22 inches, covered or coated with iron, has yielded 2000 impressions without its being necessary to remove and renew the iron coating, there being no perceptible difference between the first and last impression, the work on the plate appearing not to have suffered in the slightest degree. Hence, in future, by the application of the invention, it will only be necessary to multiply electro casts to such an extent as may be necessary to ensure the production of prints or impressions with the requisite speed on paper, calico, or other fabrics. At the same time an original engraving on copper would become, when treated according to the invention, more lasting than if engraved on steel. Although original surfaces engraved in relief, and also electro and other casts taken from them, yield a considerably greater number of impressions than those I have mentioned as obtained from plates engraved in intaglio, to which the invention has not been applied, nevertheless, the invention is applicable with great advantage to such relief printing surfaces, whether of copper or other soft metal, for if they be coated with iron according to the invention, they will yield almost an indefinite number of impressions, provided the iron surface be renewed as often as may be necessary, and the printing surfaces be again re-coated.

In carrying out the invention, I prefer to use that modification of Grove's battery known as Bunsen's, and I do so because it is desirable to have what is called an intensity arrangement. The trough I use for containing the solution of iron in which the engraved printing surface is to be immersed in order to be coated is lined with gutta percha, and it is 45 inches long, 22 inches wide, and 32 inches deep. In proceeding to prepare for work, the trough, whether of the size abovementioned or otherwise, is filled with water in combination with hydrochlorate of ammonia (sal ammoniac) in the proportion of 1000 lbs. by weight of water, to 100 lbs. of hydrochlorate of ammonia. A plate of sheet iron, nearly as long and as deep as the trough, is attached to the positive pole of the battery, and immersed in the solution. Another

plate of sheet iron, about half the size of the other, is attached to the negative pole of the battery, and immersed in the solution, and when the solution has arrived at the proper condition, which will require several days, the plate of iron attached to the negative pole is removed, and the printing surface to be coated is attached to such pole, and then immersed in the bath till the required coating of iron is obtained thereto. If, on immersing the copperplate in the solution, it be not immediately coated with a bright coating of iron all over, the bath is not in a proper condition, and the copperplate is to be removed and the iron plate attached and returned into the solution. The time occupied in obtaining a proper coating of iron to a printing surface varies from a variety of causes, but a workman after some experience, and by careful attention, will readily know when to remove the plate from the solution; and it is desirable to state that a copperplate should not be allowed to remain in the bath and attached to the negative pole of the battery after the bright coating of iron begins to show a blackish appearance at the edges. Immediately on taking a copperplate from the bath great care is to be observed in washing off the solution from all parts, and this I believe may be most conveniently done by causing jets of water forcibly to strike against all parts of the surface. The plate is then dried and washed with spirits of turpentine, when it is ready for being printed from in the ordinary manner.

If an engraved copperplate be prepared by this process, instead of a comparatively limited number of impressions being obtained and the plate wearing out gradually, a very large number can be printed off without any sign of wear in the plate, the iron coating protecting it effectually; the operation of coating can be repeated as many times as required, so that an almost unlimited number of impressions can be obtained from one plate, and that a copper one.

This process will be found extremely valuable for electrotype plates and also for photogalvanic plates, since they can be so protected as to acquire the durability of steel, and more so, for a steel plate will require repairing from time to time, these will not, but simply re-coating whenever it is found necessary; by these means one electro copperplate has yielded more than 12,000 impressions, and was found quite unimpaired when examined minutely.

It is easy to appreciate the importance of this invention as applied to artistic or line engraving more especially, for a copperplate being once engraved, if submitted to the acierage process, will become a lasting property, not liable to deterioration by printing, and the public may expect to be supplied with the very best impressions at a more moderate charge, whilst to the numerous branches of commercial engraving, for the ceramic manufactures and others, as well as to the vast number of old engraved copperplates existing in this country, this process is likely to confer an immense additional value.

I need not say that copper is not by no means the only metal to which the process is applicable, for the same principle will be found to answer in the case of other soft metals used for printing purposes, and I shall only add, in conclusion, that although the principle of electro-

typing has been applied up to the present date in a variety of ways since it was organized by Thomas Spencer, in 1837, this is, I believe, the first time that an attempt has been successfully made to prepare an engraved copperplate with harder metal, with the view of increasing its printing capabilities, and I feel happy to have been the first to introduce so valuable a discovery into this, my adopted country.

For the Journal of the Franklin Institute.

Particulars of the Steamer Albatross.

Hull built by George Greenman & Co., Mystic Bridge, Connecticut. Machinery by the Corliss Steam Engine Company, Providence, R. I. Owners, Commercial Steamboat Company.

HULL.—

Length on deck,	158 feet.	
Breadth of beam, (molded,)	30 "	
Depth of hold,	10 "	
" to spar deck,	10 "	
Frames, *molded*,		13 inches.
" *sided*,		10 & 12 "
" apart at centres,		26 "
Depth of keel,		14 "
Draft of water { forward,	11 "	
Draft of water { aft,	13 "	
Area of immersed midship section at load draft,	310 sq. ft.	
Tonnage, 450.		
Masts, 3.—Rig—Schooner.		

ENGINES.—Upright direct action.

Diameter of cylinders, two,		34 inches.
Length of stroke,	2 feet 10 "	
Cut off, within one half.		
Maximum pressure of steam in pounds, 45.		
Maximum revolutions at above pressure, 75.		

BOILER.—One—Return flue.

Length of boiler,	24 feet.	
Breadth "	10 "	
Height " exclusive of steam chimney,	10 "	8 inches.
Weight " without water, 52,000 lbs.		
Number of furnaces—two.		
Breadth of "	4 "	6 "
Length of grate bars,	6 "	
Number of flues, { above 14. / below 10.		
Internal diameter of flues, { above 12 ins. / below 6 of 15 ins. and 4 of 17 "		
Length of flues or tubes, { above 17 ft. 6 ins. / below 10 ft. 6 ins.		
Diameter of smoke pipe,	4 feet.	
Height "	20 "	6 "

PROPELLER.—

Diameter of screw,	10 feet	8 inches.
Length of "	2 "	
Pitch of screw,	19 "	
Number of blades, 4.		

Remarks.—Filled solid under engines. One independent steam, fire, and bilge pump. Boiler, chimney, and smoke pipe protected from com-

municating fire by felt and sheet iron. The hull is coppered. The boilers are on deck and has water bottoms. Has a poop cabin. Date of trial, December 22d, 1858. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Arizona.

Built by Harlan & Hollingsworth, Wilmington, Delaware. Intended service, New Orleans to Brazos.

HULL.—

Length on deck,		201 feet 6 inches.
Length on deck at load line,		200 "
Breadth of beam,		34 "
Depth of hold,		10 "
" to spar deck,		17 " 6 "
Length of engine space,		75 "
Draft forward, light,		4 " 6 "
" load,		7 "
Draft aft, light,		5 " 2 "
" load,		8 " 2 "
Tonnage,	Hull, 632.	
	Engine room and bunkers, 236.	
Area of immersed section at load draft,		228 sq. feet.
Speed in knots,	with tide, 14½.	
	against tide, 10.	

Masts, 2.—Rig—Schooner.

ENGINES.—Vertical beam—condensing.

Diameter of cylinder,	44 inches.
Length of stroke,	11 feet.
Cut-off,	5 " 6 "
Maximum revolutions,	17¼.
Weight of engines,	360,000 lbs.

BOILER.—One—Return flued.

Length of boiler,		24 feet.
Breadth "		15 " 6 inches.
Height " exclusive of steam chests,		7 " 7 "
Weight " with water,	130,000 lbs.	
Number of furnaces,	4.	
Breadth "		3 " 5 "
Length of grate bars,		6 " 2 "
Number of flues,	above 8.	
	below 8.	
Internal diameter of flues,	above 1 ft. 5¾ ins.	
	below 2 ft. by 1·6 ins.	
Length of flues,	above 14 ft. 2 ins.	
	below 15 ft. 6 ins.	
Heating surface,		1880 sq. ft.
Diameter of smoke pipe,		5 " 3½ "
Height "		33 " 8 "
Load on safety valve per square inch,	30 lbs.	
Consumption of coal per hour,	⅞ ton.	

PADDLE WHEELS.—

Diameter overboards,	30 feet.
Length of blades,	6 " 6 inches.
Depth of blades,	22 "
Number "	21.

Remarks.—Frame | 3⅝ ins. × 1 in.—18 ins. apart; 12 strakes of

plates from keel to gunwale, $\frac{3}{8}$ to $\frac{1}{2}$ inch thick; four bulkheads. Diameter of rivets $\frac{5}{8}$ and $\frac{3}{4}$. Distance apart, 2 inches; single riveted. Depth of keel, 5 ins. Dimensions of ditto ∪ $\frac{1}{2}$ inch plate. One independent steam, fire, and bilge pump. Flanch iron clamped around the gunwale 24 ins. in width by $\frac{1}{2}$ inch thich, with knees to each frame. Keelsons, 12; fore and aft, 20 inches high. Date of trial Jan. 1859.

C. H. H.

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*The Drinking Waters of the Metropolis.** By EDWIN LANKESTER, M.D., F.R.S., M.R.I.

[Abridged from a paper read at the Royal Institution.]

The water used in London for drinking purposes is obtained from both rivers and springs. The Thames and the New River, and partially other rivers, supply the river water. The spring water is of two kinds. First, from surface wells, obtained by digging through the gravel which covers the London clay in the western parts of the metropolis, and into the clay itself. Secondly, from deep wells, which generally pass through the London clay and penetrate the chalk below. The surface wells receive the soakage of the water which falls over London, and the water is contaminated by the contents of cesspools, drains, and sewers. The deep wells receive their supply of water from the chalk which forms the sides of the great "London Basin." All these waters contain more or less of the following mineral constituents:—

1. *Carbonate of Lime*, of which 3 to 17 grains are contained in the gallon. The carbonate of lime is the most common source of the *hardness* of the waters of London. It may be got rid of by Clark's process, which consists in adding lime to the water. This process would greatly improve the Thames water. This plan is carried out most successfully on a large scale at Plumstead. It was recommended by the government Commissioners, on account of its "health, comfort, and economy."

2. *Sulphate of Lime*, in the proportion of from 1 to 15 grains in the gallon. It decomposes in contact with organic matters, and produces sulphureted hydrogen. Very small quantities of organic matter serve to produce this effect.

3. *Chloride of Sodium* exists in Thames water, from 1 to 4 grains in the gallon; in deep wells, from 10 to 17 grains; and in surface wells, from 20 to 40 grains. In the Thames it may be the produce of the tide; in the deep wells it is washed out of the chalk; but in the surface wells, where it is most abundant, it is derived from the animal and vegetable refuse of the houses through which it percolates. The analyses of above one hundred of these wells showed that they were all equally open to suspicion on this point.

4. *Phosphates and Silica* exist in all the London waters in small quantities.

5. *Ammonia* also has been detected in small quantities in the Thames;

* From the London Mechanics' Magazine, July, 1858.

in much larger and more appreciable quantities in the surface wells. This substance is the result of the decomposition of animal matter, and in the surface wells is undoubtedly derived from human excretions.

6. *Nitrates* result from the oxidation of the ammonia. They are absent in deep wells, exist only in very small quantities in the Thames, but in large and sometimes even dangerous quantities in surface wells. In one water, examined by Mr. Noad, above 50 grains in the gallon were detected.

The *organic* matters are not injurious when fresh or recent, but they assume certain conditions of decomposition which occasionally render them deadly. Their influence may be estimated by the case of the Lambeth and Vauxhall Water Company's supply, during the years 1848 and 1854,—two years in which cholera visited London. In 1848, both companies derived their supply of water from the Thames at Battersea, and both supplied the same district with water, and the houses supplied were equally visited with cholera.

But in 1854, the Lambeth Company obtained an improved supply high up the Thames, at Ditton. The consequence was, according to Dr. Snow's calculations, that the deaths amongst the population supplied by the Vauxhall Company, as compared with the Lambeth, was as 7 to 1; according to the most favorable view of the case, as given by Mr. Swain, it was 3½ to 1. There is nothing to account for this difference but the larger quantity of organic impurity in the water supplied by the Vauxhall Company, which still obtains water from the more impure source. The outbreak of cholera in the Golden-square district in September, 1854, was traced to the pump in Broad street, which was subsequently found to have communicated with the drain of a neighboring house.

It appears, also, that water containing organic matter acts on lead, and thus adds another source of poisoning to its own. This had been pointed out by Mr. Noad and Dr. Medlock. Organic matters in standing water undergo a kind of fermentation, by which carbonic acid, sulphureted hydrogen, and other gases are got rid of, and nitric acid is formed. The water thus undergoes a process of self-purification. This occurred in Thames water, and accounts for the fact that ships were often supplied with water from the Thames below London Bridge. This water is dangerous to drink before or during the fermenting process.

The appreciation of small quantities of organic matters by chemical processes is a difficult process. During the evaporation of water, the organic matters are dissipated, and not all left in the evaporating basin.

The microscope is an important aid. It detects the nature of organic impurities. These consist of *dead* and *living* animal and vegetable matters. The dead consist of the tissues of animals and plants. The source of these impurities can in some instances be made manifest. Such impurities are very manifest in the Thames and surface-well waters, scarcely to be detected in the deep-well waters. The living matters consist of plants and animals. The filaments of microscopic *Fungi* have been found in impure well water. They have been detected

in several waters known to have been productive of disease. The lecturer had recorded two instances (*Quarterly Journal of Microscopical Science*, vol. iv, p. 270), and others had been published.

Amongst the living animals, the forms of *Infusoria* are most abundant. These are frequently indicative of the impure condition of water. Eggs of the higher animals are not unfrequently found in the Thames water; and some of these undoubtedly belong to those forms of *Annulosa* which find their highest development in the human body.

Many of these forms of animal and vegetable life are not injurious in themselves; but they are most numerous where there is the greatest amount of impurity, and are a measure of the greater or less objectionable nature of a water for drinking purposes. They are not present in water freshly drawn from deep wells.

From these circumstances it is concluded that the water from deep wells is most desirable and unobjectionable as drinking water; *that the water from surface wells ought under no circumstances to be drunk at all;* and that, if Thames water is used, it ought to be filtered, or, what is better, *boiled and filtered.* Boiling expels the carbonic acid from water, and renders it vapid; but its briskness may be restored by passing it through the gazogene. In the filtration of water various agents may be used, as sand, sponge, charcoal, rock, &c. The most effectual is animal charcoal, which may be introduced into any of the ordinary forms of filter. Dr. Medlock has shown that the addition of iron to water containing organic impurities precipitates them without rendering the water metallic. Water which had been filtered in contact with iron twelve months since is still quite pure, while water which has not been thus filtered shows a large quantity of impure vegetable growth.

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*Hearder's Patent Telegraph Cables.**

The invention consists of an improved mode of insulating telegraphic wires for submarine purposes, so as to lessen the inductive action usually known as a statical charge of the surfaces of the insulating sheath or covering, after the manner of a Leyden jar, which action now interferes with the operation of the simple dynamic electric current. He effects this in the following manner:—First, he covers the conductor with cotton, silk, wool, hair, flax, or other fibrous or porous substance or substances, in any of their forms, in one or more layers, previously to coating it with the insulating material, which material may be india rubber, gutta percha, or any of their compounds, or any other insulating composition; or, secondly, he coats the wire with the insulating material, and then applies any of the before-mentioned porous or fibrous substances over the insulating coat, and covers the whole again with the insulating material, and, if necessary, puts on additional alternate layers of fibrous and insulating material; or, thirdly, coats the conductor with the fibrous, porous, or textile materials in the manner described in the first process, and then applies the alternations of insulating and fibrous materials in the manner described in the second process.

* From the London Mechanics' Magazine, September, 1858.

The porous, fibrous, or textile material with which the conductor is covered, or which is inserted between the layers of the insulating medium, is better for having its porosity preserved as much as possible consistently with the required strength of the cable.

The precise mode of laying on the fibrous materials may vary according to circumstances, but he prefers to lay them on when used in the form of threads or strands in a long spiral direction; and, when more than one layer is used, each layer is better for being put on in the direction opposite to the former one; or, where economy is not a great object, they may be braided on. When in the form of tapes or strips, they may either be wrapt spirally around, or laid longitudinally along the insulated or uninsulated wire, and folded round it; the latter mode being preferable, as it gives greater strength. In all cases, he recommends the employment of a soft, adhesive insulating medium, which shall adhere to the fibrous material as well as to the surface of the more solid insulating substance used for the several castings in order to prevent the layers from sliding over each other. He does not, however, confine himself to any of these plans, but merely recommends them as among the best modes of combining the porous or fibrous substances with the insulated material.

As telegraph cables are usually constructed, the gutta percha or other insulating substance which encloses the conductor, acts the part of a Leyden jar, the internal conductor serving as the inner coating, and the water as the outer coating; and his object is to interpose a fibrous or porous substance between the wire and the insulating coating, in order to prevent the contact of the metal with the homogeneous surface of the insulating medium; and, for a similar reason, he also puts on the outer layer or layers of porous and insulating materials, viz: to prevent the water, or other external conductor, from coming in contact with and forming an external coating to the insulating sheath, which more immediately includes the conductor.

Where two or more conductors are to be embodied in the same cable, he takes the requisite number of conductors prepared in any of the ways aforesaid, and either binds them together with the porous materials before described, and then covers them with insulating medium, or unites and covers them with insulating medium at once; or he applies the porous, fibrous, or textile material and the insulating medium over the whole, when thus united, in alternate layers, as before described.

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*On the Annual Yield of Nitrogen per Acre in Different Crops.** By J. B. Lawes, F.R.S., F.C.S., and J. H. Gilbert, Ph.D., F.C.S.

In a paper given last year at the Dublin Meeting, on the question of the Assimilation of Free Nitrogen by Plants, and some allied points, the authors had stated in general terms, that the amount of nitrogen yielded per acre, per annum, in different crops—even when unmanured—was considerably beyond that annually coming down, in the forms

* From the London Chemical Gazette, No. 385.

of ammonia and nitric acid, in the yet measured and analyzed aqueous deposits from the atmosphere. The investigations then referred to were still in progress; and a desirable introduction to the record of the results would obviously be, to illustrate by reference to direct experiment, that which had been before only assumed, regarding the yield of nitrogen in our different crops. To this end, had been determined, the annual produce of nitrogen per acre, in the case of various crops, which were respectively grown for many years consecutively on the same land; namely, wheat, 14 years; barley, 6 years; meadow hay, 3 years; clover, 3 years out of 4; beans, 11 years, and turnips, 8 years. In the majority of the instances referred to, the yield of nitrogen had been estimated, both for the crop grown without manure of any kind, and for that with purely mineral manure—that is, excluding any artificial supply of nitrogen. It was the object of the present communication to give a summary view of some of the facts thus brought to light.

Beans and clover were shown to yield several times as much nitrogen per acre as wheat or barley. Yet the growth of the leguminous crops, *carrying off* so much nitrogen as they did, was still one of the best preparations for the growth of wheat; whilst *fallow* (an important effect of which was the accumulation within the soil of the available nitrogen of two years into one), and *adding nitrogenous manures*, had each much the same effect in increasing the produce of the cereal crops.

Other experimental results were adduced, which illustrated the fact, that 4 years of wheat, alternated with *fallow*, had given as much nitrogen in the 8 years as 8 crops of wheat grown consecutively. Again, 4 crops of wheat, grown in alternation with *beans*, had given nearly the same amount of nitrogen per acre as the 4 crops grown in alternation with fallow; consequently, also much about the same as the 8 crops of wheat grown consecutively. In the case of the alternation with *beans*, therefore, the whole of the nitrogen obtained in the beans themselves was over and above that which was obtained during the same series of years in wheat alone, whether it was grown consecutively, or in alternation with fallow.

Interesting questions arose, therefore, as to the varying sources, or powers of accumulation, of nitrogen in the case of crops so characteristically differing from one another as those above referred to.

It has been found that the leguminous crops, which yielded in their produce such a comparatively large amount of nitrogen over a given area of land, were not specially benefited by the direct application of the more purely nitrogenous manures. The cereal crops, on the other hand, whose average yield of nitrogen under equal circumstances was comparatively so small, were very much increased by the use of direct nitrogenous manures. But it was found that, over a series of years, only about $\frac{4}{10}$ths of the nitrogen annually supplied in manure for wheat or barley (in the form of ammonia salts or nitrates), were recovered in the immediate increase of crop. Was any considerable portion of the unrecovered amount drained away and lost? Was the supplied nitrogenous compound transformed in the soil, and nitrogen in some form

evaporated? Did a portion remain in some fixed and unavailable state of combination in the soil? Was ammonia, or free nitrogen, given off during the growth of the plant? Or, how far was there an unfavorable distribution, and state of combination, within the soil, of the nitrogenous matters applied directly for the cereal crops—those, such as the leguminous crops, which assimilated so much more, gathering with greater facility, and from different ranges of soil, and leaving a sufficient available nitrogenous residue within the range of collection of a succeeding cereal crop? These questions, among others which their solution more or less involved, required further elucidation, before some of the most prominent of agricultural facts could be satisfactorily explained.

Comparing the amount of nitrogen yielded in the different crops, when grown without nitrogenous manures as above referred to, with the amount falling in the measured aqueous deposits, as ammonia and nitric acid, it appeared, taking the average result of the analysis of three years rain, that all the crops yielded considerably more, and some very much more, than so came down to the soil. The same was the case when several of the crops had been grown in an ordinary rotation with one another, but without manure, through two or three successive courses. Was this observed excess in the yield over the yet measured sources, at all materially due merely to exhaustion of previously accumulated nitrogenous compounds within the soil? Was it probably attributable chiefly to the absorption of ammonia or nitric acid from the air, by the plant itself, or by the soil? Was there any notable *formation* of ammonia or nitric acid, from the free nitrogen of the atmosphere? Or, did plants generally, or some in particular, assimilate this free nitrogen?

As already intimated, some of the points which had been alluded to were at the present time under investigation; the authors having in this, the able assistance of Dr. Pugh. Others, it might be hoped, would receive elucidation in the course of time. There, of course, still remained the wider questions—of the original source, and of the distribution and circulation of *combined nitrogen* in the soil, in animal and vegetable life on the earth's surface, and in the atmosphere above it?

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 17, 1859.

John C. Cresson, President, in the chair.

John Agnew, Vice President. } Present.
I. B. Garrigues, Recording Secretary. }

The minutes of the last meeting were read and approved.

Letters were read from the K. K. Geologischen Reichstanstalt, Vienna, Austria; and Edward Miller, Esq., of St. Louis, Missouri.

Donations to the Library were received from the Commissioner of Patents, and the Statistical Society, London; the K. K. Geologischen Reichstanstalt, Vienna, Austria; L. A. Huguet-Latour, Esq., and George W. Weaver, Esq., Montreal, Canada; the Regents of the University of the State of New York, Albany, New York; Edward Miller, Esq., and the St. Louis Mercantile Library Association, St. Louis, Missouri; Cornelius A. Walborn, Esq., Pennsylvania Legislature, Harrisburgh, Penna., and from Dr. T. B. Wilson, Prof. John C. Cresson, Prof. B. H. Rand, Philip Price, Esq., and the Mercantile Library Association, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement for January 1859, was read.

The Board of Managers and Standing Committees reported their minutes.

Candidate for membership in the Institute (1) was proposed, and the candidates proposed at the last meeting (3) were duly elected.

The Standing Committees for the ensuing year were appointed by the President, and approved as follows:

On the Library.

John Allen,
James H. Cresson,
George Erety,
B. B. Gumpert,
Raper Hoskins,
James T. Lukens,
Samuel Middleton,
Henry K. Plumly,
John H. Quail,
Thomas S. Stewart.

On Cabinet of Models.

Wm. B. Bement,
Spencer Bonsall,
Wm. H. Clark,
Richard H. Downing,
George C. Howard,
Henry Howson,
Coleman L. Nicholson,
John L. Perkins,
Charles E. Smith,
Charles J. Shain.

On Cabinet of Minerals.

Isaac H. Conrad,
John F. Frazer,
F. A. Genth,
Isaac B. Garrigues,
John L. Le Conte,
J. P. Lesley,
B. Howard Rand,
Robert E. Rogers,
John C. Trautwine,
Wm. M. Uhler.

On Cab. of Arts & Manuf.

James C. Booth,
Thomas Bickerton,
Samuel Broadbent,
Henry Bower,
Robert C. Cornelius,
Edward P. Eastwick,
David M. Hogan,
Edward H. Ladd,
Wm. S. Levering,
Henry J. Taylor.

On Exhibitions.

John E. Addicks,
John Agnew,
James H. Bryson,
James H. Cresson,
John M. Gries,
William Harris,
Thomas S. Stewart,
William Sellers,
Isaac S. Williams,
Thomas J. Weygandt.

On Meetings.

Wm. B. Atkinson,
James H. Billington,
James Dougherty,
Henry Howson,
Washington Jones,
Angus F. Macpherson,
Wm. D. Parrish,
B. Howard Rand,
Richard A. Tilghman,
Joseph K. Wheeler.

On Meteorology.

Chas. M. Cresson,
John F. Frazer,
Samuel S. Garrigues,
E. Otis Kendell,
James A. Kirkpatrick,
Alfred L. Kennedy,
James A. Meigs,
Fairman Rogers,
James A. Sommerville,
Thomas J. Weygandt,